AN INVESTIGATION INTO COMMUNITY FISHING PRACTICES AROUND MNEMBA ISLAND, ZANZIBAR, TANZANIA

By

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DECLARATION

I, Mogammad Ziyaad Allie, hereby declares that the dissertation, “An investigation into community fishing practices around Mnemba Island, Zanzibar, Tanzania”, which I hereby submit for the degree of Master of Science (Environmental Management), is my own work and has not been submitted previously by me for a degree at this or any other institution.

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M.Z. Allie November 2019

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Do you not see that Allah sends down rain from the sky and makes it flow as springs [and rivers] in the earth; then He produces thereby crops of varying colours; then they dry and you see them turned yellow; then He makes them [scattered] debris. Indeed in that is a reminder for those of understanding. (Qur'an, 39:21)

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ABSTRACT

Zanzibar is a region with a rich coastal biodiversity, with the marine environment providing a vast majority of the nation's income through fishing and tourism activities. These coastal resources consist of white sandy beaches and clear blue water, rich in biodiversity and ecosystem processes. The human coastal populations residing in many of the coastal villages rely on the ocean to provide means of sustenance and income through fishing activities. In order to effectively manage these coastal resources, an integrated resource and environmental management approach needs to be adopted. This study aimed to identify and investigate the current fishing practices used by local fishermen by means of semi-structured interviews and informal discussions with local fishermen and villagers. The study shows that a vast majority of the fishermen, who reside in the villages surrounding Mnemba Island, are of the opinion that the increased number of tourist-related activities has resulted in a decline in fish stocks. This was attributed to the steady increase in the number of fishermen, as well as the lack of proper fishing vessels and equipment. This study also assessed data provided by the &Beyond Lodge situated on Mnemba Island. The study provides recommendations and conclusions for effective fisheries management in order to achieve a sustainable fishing model for the fishing grounds surrounding Mnemba Island, Zanzibar, Tanzania.

Keywords:
Biodiversity
Fishing practices
Mnemba Island
Interviews
Sustenance

OPSOMMING

Zanzibar spog met wit sandstrande, helderblou water en ’n groot biodiversiteit kuslangs. Naas toerisme is visvang die vernaamste inkomstebron. Die inwoners van talle kusdorpe maak immers ’n bestaan uit visvang. ’n Geïntegreerde hulpbron- en omgewingsbestuursplan is noodsaaklik om hulpbronne langs die kus volhoubaar te benut. Hierdie studie het gepoog om die heersende visvangpraktyke te bepaal deur halfgestruktureerde onderhoude en informele gesprekke met vissers en kusbewoners te voer. Data wat deur die &Beyond Lodge op die eiland Mnemba verstrek is, is ook by die studie betrek. Dit blyk dat die meeste vissers, wat op die eiland Mnemba woon, van mening is dat groeiende toerisme ’n daling in visgetalle tot gevolg het. Hulle skryf die kleiner vangste insgelyks toe aan ’n geleidelike toename in die aantal vissers en ’n gebrek aan behoorlike vissersvaartuie en toerusting. Hierdie studie doen ten slotte aanbevelings vir ’n volhoubare bestuursmodel in die visvanggebied om die eiland Mnemba digby Zanzibar in Tanzanië.

Sleutelwoorde:
Biodiversiteit
Visvangpraktyke
Mnemba Eiland
Onderhoude
Lewensdmiddele

IQOQO

I-Zanzibar iyisiyingi esinothe ngenhlobo eyahlukahlukene yendalo yemvelo engasogwini lolwandle, kanti indawo yasolwandle yiyo kanye engenisa imali eningi ngemisebenzi yokudoba kanye nemboni yezokuvakasha. Le mithombo eyigugu elingasogwini lolwandle yequkethe amabhishi anezihlabathi zolwandle ezimhlophe kanye namanzi acwebezelayo, kanti inothile ngendalo yemvelo kanye nohlelo lwendalo yemvelo. Izihlwele zabantu ezihlala ngasogwini lolwandle ezigodini eziningi ezigudle ulwandle impilo yazo yencike olwandle ukuze iziphilise futhi ingenise imali ngokudoba izinhlanzi. Ukuze le ithombo yempilo yasolwandle ilawulwe ngendlela efanele, kudingeka uhlelo lwezokuphathwa kwendawo olwamukelekile. Lolu cwaningo luhlose ukuvumbulula kanye nokuphenya izingqubo zokudoba ezisetshenziswa abadobi basekhaya ngokuqhuba izinhlolovo ezihleliwe kanye nezingxoxo ezingahlelekile nabadobi bendawo kanye nezakhamuzi zalezo zigodi. Ucwaningo selukhombisile ukuthi inqwaba yabadobi abahlala ezindaweni ezigudle isiQhingi saseMnemba zinombono wokuthi inani elengeziwe lemisebenzi emayelana nezivakashi yiyo kanye esedale ukuthi inani lezinhlanzi linciphe kanti futhi lokhu sekuholele ekutheni kukhule inani labadobi basezindaweni lezo zasemakhaya kanye nokwentuleka kweziketshana zokudoba ezifanele kanye nezisetshenziswa. Lolu cwaningo futhi luhlola idatha enikezelwe yi--*the &Beyond Lodge* engasesiQhingini saseMnemba. Ucwaningo lunikeza izinqumo kanye neziphetho ezimayelana nokuphatha kahle ukuze kufinyelelwe kwimodeli yezokudoba esimelele ukwenzela indawo yokudoba ezombeleze isiQhingi saseMnemba, e-Zanzibar kanye naseTanzania.

Amagama agqamile:

Izinto eziphilayo

Imikhuba yokudoba

Isiqhingi saseMnemba

Izingxoxo

Ukuphaka

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ABBREVIATIONS AND ACRONYMNS

Abbreviation	Term in full
ACRA	Associazione Cooperazione Rurale in Africa
CDF	Community Development Fund
DFMR	Department of Fisheries and Marine Resources
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organization of the United Nations
GOZ	Government of Zanzibar
ICM	Integrated Coastal Management
ITQ	Individual Transferable Quota
MIMCA	Mnemba Island Marine Conservation Area
MPA	Marine Protected Areas
MLRA	Marine Living Resources Act
NGO	Non-Governmental Organisation
SES	Social-Ecological Systems
SSF	Small Scale Fisheries
TAC	Total Allowable Catch
TAE	Total Allowable Effort
UNGA	United Nations General Assembly

Chapter 1
STATEMENT OF RESEARCH PROBLEM

1.1 INTRODUCTION

> *They buy too much, too much fish, and you know how many restaurants there are? Every day they need fish. You know, before the people are catching fish like now, but they had no-one to sell it to, but now we have a good market, so we just want to catch more and more.*
> (A Nungwi fisherman, 2018)

Fish makes a vital contribution to the food and nutritional security of over 200 million Africans. Fishing provides income for over 10 million, but globally fish stocks are severely over-utilised. At a global level, there is an increased emphasis on the important role of small-scale fisheries in contributing to food security (Isaacs & Witbooi, 2019). According to Gammage *et al*. (2019), fishers operating on smaller scales are vulnerable to stressors at multiple temporal and spatial scales that drive change in marine Social-Ecological Systems (SES). Apart from natural variability, the effects of anthropogenic change and developmental challenges add to the complexity and uncertainty. Fishers need to implement response strategies proactively to achieve sustainable livelihoods and well-being. To do so, the impact and interplay of drivers of change within SES need to be understood better.

The fishing industry plays a vital role as a source of food to many local Zanzibaris and also contributes significantly to the economy of the several local coastal communities. According to Jiddawi and Öhman (2002), small-scale artisanal fishery accounts for the majority of fish catch produced by the fishermen in the country. These fishermen mainly operate in shallow waters within the continental shelf, using traditional fishing vessels including small boats, dhows, canoes and outrigger canoes (Photograph 1.1). Various fishing techniques are applied using uncomplicated passive fishing gears, such as basket traps, fence traps, nets, as well as different hook and line techniques. Fishing has always been a major part of

the Zanzibari culture and traditions, as the island is surrounded with rich marine biodiversity and resources.

Photograph 1.1 Fishing boat (dhouw) docked at Stonetown Harbour

A large portion of the people of Tanzania rely on these resources obtained from a variety of productive marine biotopes (combination of the physical habitat as a place where animals and/or plants live as a community of animals and plants) (Costello & Emblow, 2005), which include coral reefs, mangroves, seagrass beds and estuaries along the 850km stretch of the Tanzania coastline and around the islands. These coastal waters provide resources of enormous importance for the well-being and survival of the communities, who are involved in the fisheries industry in one form or another (Jiddawi & Öhman, 2002). However, these resources need to be shared with another industry competing for its attention, namely tourism. This dissertation and the research address two issues, which are interconnected in the Zanzibari context, fishing and fishing practices of Zanzibar and tourism. The latter is included as the type of tourism that Zanzibar encounters mainly due to its rich marine life. Both tourism and the fisheries industry are reliant on these precious marine resources.

In the late 1980s, tourism was identified as a sector with major potential for driving economic development in Zanzibar and is currently recognised as one of the biggest and fastest growing global industries (Gössling & Schulz, 2005). Tourism continues to be the largest economic activity and the main source of foreign exchange

earnings in many countries (UNWTO, 2017). According to the study conducted by Levine (2007), the world has witnessed rapidly growing tourism in most coastal nations over the last two decades. Tourists are often drawn to areas of natural beauty with white sandy beaches and clear blue water, of which Zanzibar is no exception. The government of Tanzania has viewed its parks and protected areas as an important source of international foreign exchange to support its economic development.

Choi and Sarakaya (2006) view tourism as an effective vehicle for economic development that can bring significant economic benefits to countries, especially developing economies through economic growth and poverty reduction. However, in the same way that tourism can contribute to economic growth, it can contribute negatively towards both, social and environmental factors. The increasing influx of tourists to these coastal areas often place increased pressure on the natural environment and the local communities, who depend on the natural resources for their livelihoods. According to Lange (2015), with the rapid expansion of coastal infrastructure and construction of tourist resorts, coupled with a rapidly expanding population, coastal areas along Zanzibar has been placed under pressure. In many cases, the local communities do not benefit from tourism in their communities. Often tourism infrastructure impacts on their access to previously accessible resources and areas.

Zanzibar is home to a large number of beaches, clear sea water, and coral and limestone scarps that provide excellent opportunities for beach and diving tourism. Zanzibar was developed as an attractive destination for foreign visitors after the economy of the island had suffered seriously from the decline in the spice trade. Since there is little scope for industrial development, tourism was seen as an answer to the economic predicament of the people of Zanzibar in replacing the clove industry that had been lost mainly to the Asian producers.

Zanzibar's marine environment is characterised by coral reefs suitable for snorkelling and diving, offshore islands with large coral reefs (such as Changuu, Chumbe and Mnemba), big game fish, sea turtles and dolphins. These and the sandy beaches have increasingly attracted tourists (GoZ, 2003). However, this only paints half of the picture. With the introduction of the tourism industry too, with it

came the effects of unsustainable resource management and environmental degradation. These two factors, coupled together with a vastly uneducated rural population, may result in detrimental environmental and social impacts. This research aims to investigate the perceptions and experiences of local villagers in relation to the fishing trends and practices occurring in the areas of Mnemba, Matemwe and Nungwi, Zanzibar.

As of 1994, the Zanzibar government started playing an active role in the tourism industry. They adopted a national ecotourism strategy as they believed it to be most suitable to the distinctive nature of Zanzibar and its seascape. The government of Zanzibar further believed that ecotourism should target high paying tourists to enjoy the cultural and biological diversity along the coast, to constitute a potential means for sustainable development (Thorkildsen, 2006). The food security, income and livelihoods of many coastal communities the world over are dependent on the availability of marine resources (FAO, 2012, 2016; Aswani *et al*., 2018; Gammage *et al*., 2019).

Predicted human population increase will result in increased pressure on marine resources (FAO, 2012, 2016), with natural system variability and the direct and indirect effects of anthropogenic climate change adding further strain on marine resources and the coupled Social-Ecological Systems ("SES") (Miller *et al*., 2010; Hobday *et al*., 2016). Natural system variability, together with anthropogenic challenges, such as poverty, marginalisation of communities of fishers and regulation, to name a few, serve to add layers of uncertainty and complexity. This must be understood to ensure effective and sustainable management of fishery resources and coastal zones, whilst promoting sustainable livelihoods and well-being of the communities that depend on marine resources (Miller *et al*., 2010; Hobday *et al*., 2016).

The Zanzibar Environmental Management for Sustainable Development Act, 1996 ("ZEMSDA") allows for and enables external organisations to be designated as area managers, while still allowing the state to act as an intermediary (Levine, 2007). Through this system, establishments of protected areas can be developed, however, this could lead to a complex relationship between the role players, international organisations, the state, and local communities. Zanzibar, with its

extensive coastline, coral reefs and the new emphasis on coastal and marine-based tourism, has become a focal point for marine conservation efforts in Tanzania.

Four marine protected areas were established in Zanzibar during the 1990s, namely Chumbe Island Coral Park, Mnemba Island Marine Conservation Area (MIMCA), Menai Bay Marine Conservation Area and Misali Island Conservation Area. Each of these protected areas attempts to combine marine conservation with the interests of local communities, primarily through involving local villages in the management of these areas and/or providing them with benefits derived from conservation. As with the majority of the conservation programmes in Tanzania, these areas are each funded and managed primarily by an external international organisation, two of which are NGOs and two of which are private sector ecotourism operators (Levine, 2007). Although Marine Protected Areas (MPA) exist, their effectiveness on marine and coastal management, with particular reference being made to fish stocks around Mnemba Island, is still to be determined. This new knowledge could aid in establishing a more effective management role the government can play in ensuring that sustainable fishing practices are applied around the Island.

As reported by Auster and Langton (1998), there is incontrovertible evidence showing that in heavily fished areas of the world, there are negative ecosystem-level effects and shifts in benthic community structure occur. This study will examine the possible increase in the demand for seafood products for human needs. It will focus particularly on the community fishing practices around Mnemba Island, whilst drawing on comparisons of data collected in Matemwe and Nungwi Villages and whether these increased demands are as a result of the increase in tourism resulting in changes in fishing patterns, areas and methods used by local fishermen. The artisanal fisheries of South Africa and the ways in which the implementation of a quota system had failed the subsistence fisherman will be examined. This could indicate that Zanzibar should learn from the South African case rather than adopting the same policies.

The research further aims to draw upon results of data gathered in fishing communities and then compare the three study areas. The comparative analysis will assess how the increased demand for fish by the tourism market has impacted

on livelihoods of the local people and whether they have adopted different fishing methods to supply this increased demand.

The results of this study may be used to establish a list of fish species inhabiting the area, the most targeted species by fishermen and the most sought-after fish and marine species demanded by tourists visiting the island. This can be compared to international best practice and solutions to find ways in which to manage fish stocks effectively in the region that would ensure sustainable resource use.

1.2 Background

Overfishing has a devastating impact on fisheries world-wide. Efforts to establish sustainable harvesting management systems and to foster fishery recovery, have been successful when the economic means exist to make the required changes. However, in areas of poverty, where people rely upon the fishery for subsistence, management changes are much more difficult to achieve, while the cost of collapse is correspondingly greater (Colbert-Sangree & Suter, 2015). The Zanzibar archipelago consists of several islands with a total population of about 1.3 million. Unguja, the largest island, has a population of about 900,000 followed by Pemba with over 400,000 people, according to the 2012 census (The World Bank, 2017). Zanzibar's economy is coastal-dependent and this reliance on coastal resources is likely to increase as tourism continues to grow.

> *When I was a small boy, I always wanted to go to the fishing with my father. I didn't want to go to school because I wanted to be just like my father and I wanted to be with the big boys. So now I don't have the good education, so I have to be the fisherman. I like my job, it is a good job, but sometimes when I don't catch fish then I don't have money to buy rice. But I am happy, because God made me to be a fisherman, and I catch fish for my family for them to eat.* (Matemwe fisherman)

The fishery in Zanzibar is typically tropical, being small scale and applying a variety of fishing techniques targeting many species. About 95% of the total marine catch is from this type of fisheries using traditional vessels and gear (Jiddawi & Öhman, 2002). Fishing in Zanzibar and its surrounding islands mainly consist of subsistence and semi-commercial fishing. According to the Sustainable Zanzibar Project, the largest market is the local market, which makes up 96% of the total catches. The growing population and increasing influx of tourists will most likely result in a growing

demand for fish (Photograph 1.2). This may result in the adoption of unsustainable fishing practices to support this increase in demand. According to the World Bank, economic contribution from the world's marine fisheries is significantly smaller than if it could be if fisheries were managed to their maximum sustainable yields. Estimates reveal lost revenues in fisheries to be in the region of $51 billion per year, with other estimates ranging from $46 to $90 billion per year (World Bank, 2008).

Photograph 1.2 Stone Town Darajani fish market (Largest fish market in Zanzibar)

Artisanal fisheries using traditional fishing vessels, often restricts fishermen to stay only a few kilometres from shore and the traditional gear keeps catch sizes small (Colbert-Sangree, 2012). There are over 1000 species of fish present off the coast of Tanzania and Zanzibar, and over half of them are commercially important (Jiddawi & Öhman, 2002).

> *Coral reef fish are an important source of food security and income for human coastal populations. They also underpin ecosystem processes vital for the future ability of coral reefs to generate ecological goods and services. Identifying socio-economic drivers behind the exploitation of fish that uphold these key ecosystem processes and the scales at which they operate is therefore critical for successful management. Consequently, both high and low trophic species, as well as small and large fishes are fished and sold, which leaves no refuge for the fish assemblage to escape fishing. When market agents other than fishermen have so much influence and there are few alternative income generating activities, it is not possible to place the*

> *full burden on fishermen. Management measures that extend down the value chain to include all market agents, as well as their links to ecosystem processes are thus likely needed to reach the target of sustainable fisheries.* (Thyresson *et al*., 2012, p. 246)

Situated on the east coast of Zanzibar, Mnemba Island is surrounded by coral reef which is rich in fish and plant biodiversity and as a result has been an important fishing ground for many local fishermen. As of the last 30 years, Mnemba has become a popular tourist attraction, providing excellent diving and snorkelling opportunities for tourists. Many of the fishermen stated that Mnemba Island was used as a base camp for fishermen during fishing activities in the occurrence of stormy weather events.

According to Levine (2007), who highlighted one of the main issues concerning the local fishermen and Mnemba Island, in early 2004, Mnemba Island Lodge, in partnership with other development donors, tried to provide assistance to local fishermen through the placement of an offshore fish aggregating device (FAD). This device is a type of buoy designed to attract and cluster pelagic fish and make offshore fishing easier, thus increasing local fish-catches and reducing fishing impacts on near-shore reefs. The local fishermen were highly opposed to this stating *"hatutaki boya!" ("We don't want a buoy!").* Villagers associated the FADs with the placement of buoys used by conservation programmes to mark no fishing zones. While this seeming refusal of development assistance surprised the hotel and development agency representatives funding the project, the villagers were suspicious and found it difficult to connect conservation and development assistance. They had already lost access to Mnemba Island as a fishing ground, and they feared the programme was trying to expand its boundaries to make additional areas off-limits to fishing, using deception as a means to obtain their approval.

As it turned out, these fears were not entirely unfounded. The protected area boundaries did in fact expand subsequently. The island was leased to an Italian investor whose plan was to develop the island into a tourist resort. The investor strictly prohibited fishermen from fishing around the island and entering onto the island. This resulted in conflict between the local fishermen and the investor. A solution was offered to the fishermen in the form of two motorised boats to be used

to undertake deep sea fishing. The fishermen reluctantly accepted the offer, however, after a very short time they found that they had no knowledge on how to use the boats and the bigger fishing nets. As a result they abandoned the boats and returned to their original fishing practices. Consequently, the local fisherman being banned from fishing around the island, resulted in destruction of properties on the island by the local fisherman. It was clear that some sort of agreement would have to be reached in order to satisfy the local people, as well as establishing a tourist resort on the island.

In 2002, MIMCA was established by the former Department of Fisheries and Marine Resources (DFMR) to address the conflict between people and the private company, which in 1989 leased the Mnemba Island (DFMR, 2010). In 2005, an extension of MIMCA was planned (Mohammed, 2005) and a General Management Plan (GMP) was compiled in 2010 (DFMR, 2010) to be fully implemented by 2015 (De la Torre-Castro, 2012). MACEMP (Marine and Coastal Environment Management Project), a US$60 million World Bank loan and GEF (Global Environmental Facility) grant enabled this extension (World Bank, 2012). A network of MPAs should increase the MPA coverage from 4% in 2005 to 20% by 2025 (Ruitenbeek *et al*., 2005). To reduce conflict, four zones, such as core (fishing prohibited), specific use (unclear implications), general use (general regulations) and buffer zones (unclear implications) was utilised in MIMCA (DFMR, 2010). Yet, only Mnemba Island has been demarcated as core and specific use zones, whereas the rest were defined as general use zones (DFMR, 2010).

On November 1st 2002, the area was established as a Marine Resource Reserve (MRR), known as the Mnemba Island Marine Conservation Area (MIMCA) as a joint venture between &Beyond and the communities of Kilamajun, Matemwe, Nungwi, and Pwani Mchangani. A management committee was established consisting of representatives from &Beyond and these four local villages. During the beginning stages, MIMCA had three primary goals: to stop unsustainable fishing, limit irresponsible tourism practices and give back to the local communities through a newly created Community Development Fund (CDF), comprised of money collected from a newly instituted park fee. *During this time &Beyond was responsible for collecting park fee funds and distributing them to the community. In 2003 the*

Department of Fisheries took over this responsibility (Johansen & Kennedy, 2014, p. 8).

Along with this new responsibility, the Department of Fisheries decided to take over all of the MIMCA management functions. They took over the duty of collecting and distributing funds from the CDF and it was decided that 70% of the Mnemba Island park revenue would go back into MIMCA, while 30% was designated for the community. However, revenue sharing, and allocation of the CDF has been a non-transparent process. A General Management Plan (GMP) was also written in 2010 to be fully implemented by 2015 and patrolmen or 'rangers' hired from surrounding villages were enlisted to collect park fees and enforce the MIMCA guidelines. What was initially a joint venture between &Beyond and the local communities, became an island wide project managed almost exclusively by the Department of Fisheries (Johansen & Kennedy, 2014).

In comparison to the neighbouring countries, Tanzania's Zanzibar coastal region and marine resources are regarded to be in good to excellent condition, despite the increasing pressure and demands placed on this precious resource. Misali Island is an example where Zanzibar has initiated the process to protect one of its important marine and coastal habitats. The notion of a conservation trust has been proposed, however, the implementation of these ideas was found to be lacking (DEIMS, no date).

As managing small-scale fisheries is a complex endeavour (Chuenpagdee & Jentoft, 2007), shortcomings in local fisheries management have also been described for Zanzibar (De la Torre-Castro & Lindström, 2010). These are for example illustrated in the use of illegal gear or conflicts over gear and fishing grounds in certain areas (De la Torre-Castro & Lindström, 2010). De la Torre-Castro (2012, p. 612) describes that the "dominating focus on conservation, the lack of a holistic approach and failure to consider resource users seriously" have led to unsuccessful management and that current management plans often miss the context of poverty and resource dependency (Wallner-Hahn & De la Torre-Castro, 2017). Promising approaches for the management of such small-scale fisheries have been suggested to be the seascape approach in combination with co-management and ecosystem stewardship, and a focus on resource users as central

actors (Chapin *et al*., 2010). In Zanzibar's National Integrated Coastal Management (ICM) Strategies, an emphasis is placed on community involvement in fisheries management (ICM, 2003).

According to Allie (2015), the local fishing communities who fish near Mnemba Island predominately come from the north-eastern coast of Unguja Island, mostly from villages between Matemwe and Nungwi. Targeted species mainly include tuna, kingfish and barracuda. Artisanal fishing methods are most common. Fishermen use hand-lines, traps and spearfishing from dhows and outrigger canoes. However, recent influxes in tourism have resulted in higher demands for marine resources. The result has been a diversion from traditional artisanal fishing methods to more commercial and high-production scale methods, such as the use of dragnets. These large-scale fishing methods are often illegal, increase by-catch and have greater detrimental effects on the environment. However, as the demand for fish grows, fishermen are under more pressure to provide fresh catch for local hotels and markets. This may result in over-exploitation of resources and an increase in destructive fishing methods that degrades communities within coral reefs (Johansen & Kennedy, 2014).

1.3 MOTIVATION FOR STUDY

The ever-growing dependence on marine resources calls for increased management of such assets. It is critical to understand what contributes to successful management strategies, and how said strategies adapt to growing demand for marine resources. In Zanzibar, many fishers are marginalised and live close to the extreme poverty line of US$ 1.25 per day (De la Torre-Castro *et al.*, 2014). Due to the dominance of low-technology gear and non-motorised fishing vessels, most fishers operate in shallow inshore waters at patchy and fringing coral reefs and seagrass beds, resulting in a heavy fishing pressure on these ecosystems (De la Torre-Castro *et al.*, 2014). Owing to population growth, migration, few employment opportunities, growing tourism and the open access fisheries character, the demand for marine resources is growing and signs of overexploitation of near-shore ecosystems have been reported (Jiddawi & Öhman, 2002). Taking cognizance of this, the motivation for this study is to focus on establishing whether

current fishing practices are sustainable and whether the marine and coastal habitats can support this increase in demand for fish.

1.4 RESEARCH PROBLEM

Direct and non-direct anthropogenic stress factors, such as fishing, tourism and pollution, affect fish livelihood and are made evident through habitat destruction, direct pollution and overfishing. This offset of ecological balance and productivity takes a toll on the local human communities who depend on reef resources for their livelihood (Allie, 2015; Johansen & Kennedy, 2014).

Fishing in Zanzibar and its surrounding islands mainly consist of subsistence and semi-commercial fishing. Currently, over 25% of Zanzibar's population depends on the fisheries industry for their livelihood (Johansen & Kennedy, 2014). A high variety of fish species is targeted and fishing gears used are mainly of traditional character (including dema basket traps, smaller nets and hand lines), but also more modern gear are used like larger gillnets, beach seines or spear guns (DoFD, 2010). The fish catches are used for own consumption as well as sold to local markets and fish traders, restaurants or hotels (Thyresson *et al.*, 2012).

It is obvious, not only to researchers but locals as well, that fishery resources are being depleted. A study completed in southern Zanzibar in 2012 noted that all surveyed fishermen believed their catch size per week had been at least 97% larger when they first became a fisherman (Colbert-Sangree, 2012).

With inadequate management practices due to limited resources, sparse enforcement, population growth and conflicting views, the health of the fisheries of Zanzibar are in great danger. By-catch, or accidentally caught fish could potentially accelerate the reduction in fish stocks by catching fish, which have not yet reached sexual maturity, thereby decreasing the chances of population growth. The research question guiding this study was, "How does the fishing practices of artisan fishermen affect the fishing stocks around Mnemba Island?"

1.5 AIMS AND OBJECTIVES

1.5.1 Aims

This research aimed at investigating the characteristics of current fishing practices being used by fishermen around Mnemba Island from the coastal villages of Matemwe and Nungwi. Furthermore, the research aimed at investigating the various fishing techniques that are applied and whether current fishing practices are sustainable. Daily catches and the size and types of species caught were observed, to find and ascertain whether current fishing practices are sustainable and whether the predicted increase in demand for fish caused by the increase in tourism on the island could have detrimental effects on the local fish stocks.

1.5.2 Objectives

In order to determine whether fishing practices are sustainable and if the local fish stocks can support this demand, the objectives of the study were to:

(1) Assess which species of fish are most targeted by fishermen and which species of fish are most sought after for the market (local market, as well as the Mnemba Island Lodge); to investigate whether there is a rising trend for specific types of fish due to the increase in the tourist market; and the demands which this market places on local fish stocks.
(2) Assess current fishing practices and methods of fishing that utilise passive fishing gear, such as basket traps, fence traps, spear guns, nets as well as different hook and line techniques.
(3) Investigate the implications destructive fishing methods pose on local fish stocks and the implications for local fishermen.
(4) Provide recommendations for the improvement on sustainable fishing practices for the communities surrounding Mnemba Island.

1.6 SEQUENCE OF CHAPTERS

The dissertation comprises of the following chapters, as set out below.

Chapter 1 introduces the study, setting the context and outlining the research problems, aims and objectives.

Chapter 2 reviews existing literature. It aims at introducing the reader to studies which have been conducted with a particular focus on sustainable fisheries management in areas with high tourist related activities. It further aims at highlighting the importance of coral reef fish and the ways in which it plays an important role in the health of the ecosystem.

Chapter 3 describes the research design and methodology chosen for this study, namely multiple-method qualitative approach based on a single case study with three imbedded sub-cases. The chapter describes the research design and the ways in which data collections was undertaken. The chapter then focuses on the research methodology adopted, describing the methods and techniques used to gather, process and analyse the data. The chapter concludes with a description of the three study areas, namely; Mnemba Island, Matemwe village and Nungwi village.

Chapters 4 focuses on the analysis of the results of the study and a discussion of the findings. The chapter focuses on the results and interpretation of the data provided by the Mnemba Island lodge and then moves on to discuss the data and draws on the data gathered by the researcher through the interviews conducted. The results are presented in the form of graphs and tables for ease of reference. The discussion compares existing literature on the subject to draw conclusions.

Chapter 5 provides the reader with the synthesis, recommendations and conclusion of the study. The synthesis focuses on relating the aims and objectives of the study to the results and a discussion of the data collected. The chapter concludes by providing recommendations for further investigation, as well as for recommendation for future management of fishing communities in the study areas.

1.7 SUMMARY

This chapter has served as introduction to the research, setting the context and providing a background to the tourism and fisheries industry of Zanzibar. The chapter then proceeds to provide the motivation for the study, as well as the research problem and aims and objectives for the study in the three study areas.

Chapter 2 which follows, focuses on a literature study of published related literature on fisheries, sustainable fishery and tourism, amongst others.

Chapter 2
LITERATURE REVIEW

Fisheries provide employment for 180 million people worldwide and represent a significant percentage of the animal protein consumed globally, particularly in developing countries (FAO, 2010). Fish and fishery products are one of the most widely traded agricultural commodities with exports worth more than $85 billion in 2008 (Dyck & Sumaila, 2010). Nevertheless, marine fisheries today are under pressure. While fisheries in developed countries are recovering, overfishing has impoverished the state of the marine ecosystem globally (Bonini *et al*., 2011).

2.1 INTRODUCTION

Literature reviews, as well as observations and conclusions made by the researcher have determined that increased tourism has a direct impact upon ecological and natural resources. The literature review aims to take the reader through a journey of sustainable resource use of the oceans at a global level and then scaling down to a regional and finally a local scale. It furthers aims at introducing the reader to the African tourism industry and the ways in which previous studies have focused on sustainable tourism. Although there have been studies conducted in relation to the local fishing industry and the effects of tourism for other areas in and around Zanzibar, very few studies have been undertaken for Mnemba Island. Furthermore, previous literature has shown that there are differing opinions with regard to the impacts which increased tourism is having on the local fish stocks and livelihoods of the local Zanzibari people.

2.2 OCEAN AND FISHERIES AT GLOBAL SCALE

The importance of water bodies, be it the oceans, lakes, rivers and underground water, must be managed as these precious resources are often neglected and forgotten (UNECA, 2016). The earth's surface is covered by more than 70% water and water can be considered to be the starting of all life. Of all the cities in the world,

three quarters are located along coastal areas with approximately half of the world's population living within 60km of the sea (UNECA, 2016). Trillions of dollars are generated each year through the planet's waterbodies via goods and services and both salt and freshwater provides livelihoods to millions of people. (FAO, 2014).

The world's oceans provide a vast array of ecosystem services, through rich ecosystem biological services and the regulation of global climates. Increasing emphasis is being placed on sustainable development and sustainable resource use as the world is ever increasingly becoming aware of the effects of climate change. Although debatable, the world is currently experiencing the effects of climate change as droughts are becoming more and more common as global temperatures steadily rise. As the human population grows, so pollution and other forms of environmental degradation grow. Therefore, it is incumbent for every human being to practice sustainable living and sustainable resource usage.

With growing populations comes increased demands for marine resources. The demands being placed on the earth's natural resources increases every year and in order to meet these demands, increased pressure will be placed on the planet's oil and gas reserves. For more than 60 years, offshore hydrocarbon extraction has increased tremendously. Approximately 30% of worldwide oil and gas production comes from offshore resources and this is only expected to increase in future (www.modec.com). The increased pressure on marine capture fisheries due to growing populations, rising demand for seafood, and a rapid increase in fisheries exploitation, has caused a decline in the productivity of many fisheries. Directly and indirectly, fisheries provide employment for hundreds of millions of people.

The United Nations has adopted ocean development as part of its Sustainable Development Goals (SDGs). In particular, SDG 14 refers to *"Conserve and sustainably use the oceans, seas, and marine resources for sustainable development"* (UNECA, 2016, p. 9). According to the United Nations (UNECA, 2016), aquatic and marine resources play a crucial role in supporting various economic sectors that provide employment and livelihoods to eradicate poverty (SDG 1). Because of a greater proportion of people in developing countries where the sector often plays a key role in preventing and reducing poverty, it is likely that millions more people would be involved in fishing activities than appear in official

statistics. If managed correctly and sustainable management means are implemented, fish stocks can ensure the viability of the livelihoods of the poor, and, following recovery, generate more employment in the long term (ISU, 2012).

2.3 AFRICAN FISHERIES SITUATION

> *In light of recent crises, the contribution of fish and fish products to national and global food security has never been of greater importance. Fish is a renewable and healthy food source, which currently supplies one billion people with their main source of protein*. (ISU, 2012, p. 5)

Africa is gifted with a variation of natural living and non-living resources, such as, minerals, oil and gas and an abundance of flora and fauna, both marine and terrestrial (UNECA, 2016). A large proportion of African populations are moving to coastal areas and this has resulted in associated socio-economic growth. (Figure 2.1) depicts how money flows in and out of Africa. Countries are experiencing dramatic coastal change, with increased pressure on marine resources. This has given rise to the need to manage water bodies sustainably as 'development spaces' (UNECA, 2016).

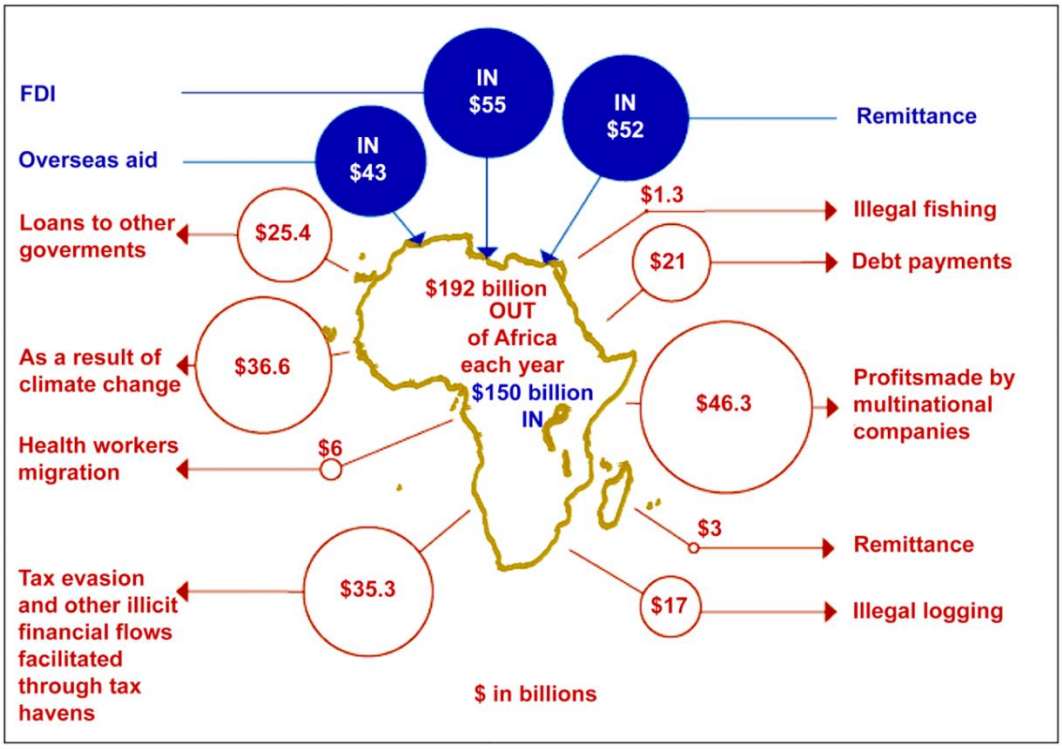


Figure 2.1 Financial resources into and out of Africa with reference to foreign direct investment (FDI), international assistance and remittances (2010) (UNECA, 2016, p. 4)

Given the nature of the African continent, with its colonial past and now its current economic situation and war-torn countries, the majority of the African continental population are subsistence-based people, living from hand to mouth and relying on natural resources to provide them with the required ecosystem-based goods and services.

> *In Africa, growth has generally not been accompanied by broad-based social progress and structural transformation of the economy. While the continent is experiencing a rising middle class, a large part of the population is still unemployed, and populations are suffering from a large unequal distribution of wealth. Around USD42 billion per year leaves the continent through illegal fishing and illegal logging, among other causes*. (UNECA, 2016, p. 3)

2.4 AFRICA AND DEPENDENCY THEORY

> *Dependency theory emerged in the 1960s in reaction to modernization theories of development, arguing that international inequalities were socially structured and that hierarchy is a central feature of the global system of societies. It sought to explicate the institutional structures by which powerful core states continued to exploit and dominate less powerful states even after decolonization and the establishment of official sovereignty in peripheral nations. Ignoring the core/periphery hierarchy is a mistake not only for reasons of completeness, but also because the ability of core capitalist states to exploit noncore resources and labor has been a major factor in deciding the winners of global competition*. (Dunn, 2015, p. 196)

In development studies, the dependency can simply be explained as the core developing at the expense of the periphery, and Africa is considered to be one of the periphery. The third world countries are considered to consist of the underdeveloped countries within Africa, Asia, Latin America and Oceania. They all share common traits, being high poverty, high birth rates and economic dependence on the advanced countries (Jeffry, 2013).

The dependency theory was chosen by the author in order to give the reader an understanding as to where Africa stands on a global economic scale and Zanzibar, in turn, is one of the 'periphery' countries, as much of Zanzibar is rural in nature and the majority of its population living subsistence-based livelihoods. Often, with globalisation and the development of technology and required technological skills

which accompany them, these subsistence-based livelihoods have a negative impact. The demand for natural resources increases has led to unsustainable resource extraction techniques in various industries, namely increased demand for agricultural land has resulted in deforestation, overfishing has resulted in declining global fish stocks and increased demands for minerals has resulted in a number of negative environmental impacts.

With its plethora of marine biodiversity and large number of species of commercially valuable marine resources, Zanzibar can be considered as a “goldmine”. However, the majority of the rural Zanzibari population live sustainable lives, only consuming what is required as the lack of infrastructure, such as electricity for freezers and simply a lack of funds in rural areas do not allow for the storage of perishable foods for long periods of time. This is the simple explanation, but there is no other explanation for it. Rural life in Zanzibar is simply that simple.

Developing regions like Zanzibar, Tanzania have scenic natural resources but little in the way of industry or industry-related natural resources, like oils, metals or minerals (Burgoyne *et al*., 2017). Thus, the tourism industry in Zanzibar can be considered to be the core and the local people can be considered to be the periphery. Zanzibar is without a doubt considered one of the periphery countries. The tourism industry in Zanzibar is thriving, but at the expense of the local people and their livelihoods. According to Burgoyne *et al*. (2017), in many different tourism settings, the business that tourism brings can have a positive impact on quality of life for the local people at a destination (Woo *et al*., 2015). Similarly, it can be an important contributor to broader social, economic and infrastructural development at a destination (Mowforth & Munt, 2015). The converse is also true. Tourism can negatively impact the natural environment and quality of life for local people (Murphy, 2013). In order to avoid some of the potentially negative impacts that tourism could have on natural resources, planning and management are vital to successful tourism destination development and protected area management (Mason, 2015).

2.5 RELATIONSHIP BETWEEN TOURISM AND FISHING IN ZANZIBAR

The Island of Zanzibar is one of vast differences. The area itself is rich in natural beauty and marine resources, however, the majority of the population, by western standards, can be considered indigent (as was noted by the researcher through observations and discussions with locals) and the influx of tourists to the Island bring both positive and negative aspects.

> *The African industry tourism relates basically to eco-tourism where tourists are interested to enjoy, appreciate and study Africa's indigenous ecosystems. However, it has become customary to associate eco-tourism as a derivative of sustainable tourism with the desire of tourists to see these ecosystems conserved and the lifestyle of the indigenous people improved.*
>
> *While tourism contributes significantly to economic growth and creation of employment, it nonetheless remains one of the major sources of coastal degradation. This is particularly attributable to the fragile marine ecosystems that are greatly disturbed because of habitat loss and fragmentation after the construction of huge hotels, swimming pools and ill-designed jetties. These environmental damages call in question the viability of eco-tourism and inevitably the sustainability of the tourist industry in the host country.* (Sobhee, 2006, p. 414)

Sobhee (2006) examines whether it would be worthwhile for local authorities to be pro-active in fisheries biodiversity conservation. As there is little evidence thus far on the status of the biodiversity of fisheries in the country, the author proceeded by establishing an index to help track the evolution of the biodiversity of fisheries over the past 25 years. Emphasis is placed on this type of diversity since, by and large, the latter represents a composite product that attracts tourists, be it in the form of food, endemic and unique species or a source of recreational activity. It is important to establish a link between tourist earnings and biodiversity of fisheries such that sustainable development policies could be implemented along with measures to promote coastal zone management.

> *Tourism has the potential to be used as a positive tool for growth in developing nations. In order to gain the most benefit from tourism, planning and management is vital for successful tourism destination development and the attainment of conservation goals. This process should involve all stakeholders who might be affected by tourism and associated developments. In order for collaboration to be effective, there are certain*

> *social aspects that need to exist in stakeholder relationships such as open communication, transparency, and trust.* (Burgoyne *et al.*, 2017, p. 239)

A study conducted by Wallner-Hahn and De la Torre-Castro (2017) analysed fishers', managers' and scientists' opinions on management measures to facilitate the initiation of management processes towards more sustainable small-scale seagrass fisheries in Zanzibar, Tanzania. The results of the study showed that in future management, emphasis must be placed on the effective management of sea grasses. There was consensus that dragnets are the most destructive gears, and the use of dragnets being a major threat to local seagrass ecosystems. The study also showed that the communities and fishers would benefit the most from effective and inclusive seagrass management (De la Torre-Castro *et al*., 2017).

This study aims to assess the ways in which the tourism industry in Zanzibar has affected the fish stocks in the areas around Mnemba Island, as well as the types of fishing methods being used.

It must be noted that, many of the local people start fishing from a very young age, and this could be due to many factors. Often, the lack of basic education and training has “forced” local people to adopt fishing as their primary source of income and food. So it is often not by choice, but rather necessity that Zanzibar has such a high number of subsistence fishermen. This in turn highlights that social drivers underpin many of the decisions local people have to make in order to sustain their lives. According to Lange (2015, p. 530), *the ability of local communities to participate in tourism is limited by poor education and training*. The high-value, international tourism industry requires high levels of training and fluency in at least one foreign language. Currently, the majority of people working in the tourism industry in Zanzibar come from mainland Tanzania, as many Zanzibaris do not receive adequate education at the primary and secondary levels, thus they are not able to enrol or meet the minimum requirements to take advantage of the tourism training programs offered by government and private organisations. This observation was noted by the researcher through participant observation and through discussions with local Zanzibaris.

Greater employment in more skilled, better paid occupations in tourism requires more investment in education (ACRA, 2008; ZATI, 2008). According to the Food

and Agriculture Organisation (FAO), globally, 30% of fish stocks are currently considered overexploited, with another 50% considered fully exploited (FAO, 2010). A vast majority of participants along the value-chain who depend on fisheries for their livelihoods are currently at risk of the collapse of fisheries, with estimates in economic activity sitting at approximately US$500 billion per year (FAO, 2010).

Prior research conducted for the region of Zanzibar assessed whether the local communities benefited from the tourist industry, or whether it has been to their detriment. The majority of the research was undertaken in an observation and participatory manner, through questionnaires and surveys conducted within local communities. In Zanzibar, approximately 25% of livelihoods is supported by the rural fishing sector (34,500 fishers in 2010) and secondary fishery services (auctioneers, traders, retailers, boat builders, etc.) (Johnson, 2010).

The focal point of the fish trade in Zanzibar is the Darajani fish market in Stone Town, which is also the main export hub. Tourist hotels and restaurants source varieties of mixed reef fish that is considered as an important local protein source (Cinner *et al*., 2013). According to Guard (2009), a critical source of food is octopus which in turn is also a growing cash generating income source in east Africa and the entire Western Indian Ocean region. Despite this, octopus fishing is rarely accounted for in management and governmental statistics (Rocliffe & Harris, 2015). Women and children are most often the ones involved in the octopus fishery and this is one of the few income sources for this social group. However, this is changing, as octopus is increasingly fished for export and women are squeezed out by male fishers (Razavi, 2009). In Zanzibar the tendency is to target multiple species and to land and sell them together. This also is true for traders who will rarely buy only one type of species.

A recent study by Benansio *et al.* (2016) investigated whether fishing communities of Zanzibar have benefited from the increasing tourism development. Figure 2.2 graphically shows how tourism influences fishing activities and vice versa. It is clear from the pie charts that areas with higher tourism have a higher fishing frequency as opposed to areas with low tourism.

The methodology mostly involved face-to-face interviews and structured questionnaires. The results indicate that increasing tourism has impacted fishers twofold: (1) Parts of their fishing grounds were lost through development of tourist infrastructure, such as resorts and hotels along the beaches area; (2) Some of the fishing gears were destroyed by tourists during activities, such as diving, snorkelling, swimming with dolphins, and boat riding over inshore waters where fishing is actively taking place.

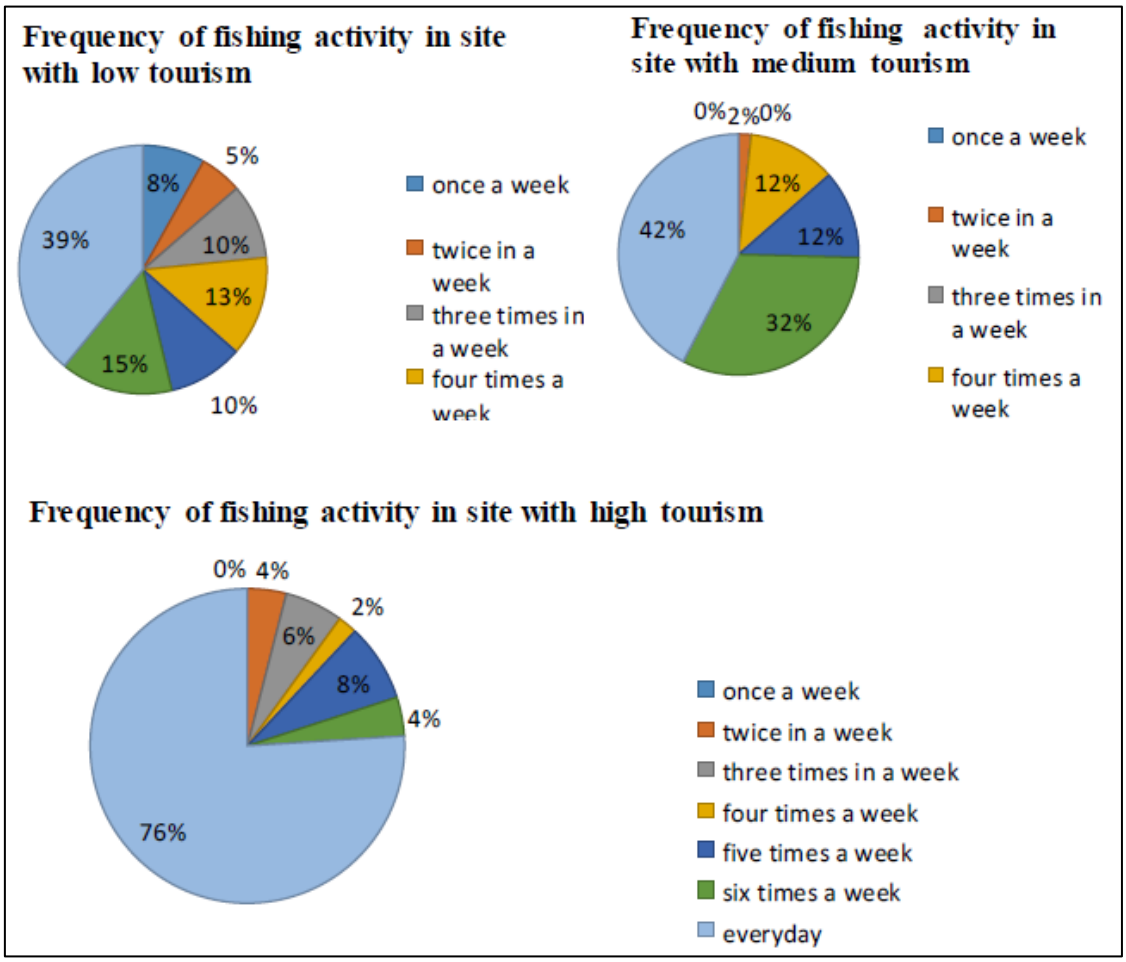


Figure 2.2 Tourism effects on fishing activity (Benansio *et al*., 2016, p. 101)

Despite the increase in tourism development and infrastructure development for tourist related activities, the living conditions of local Zanzibaris has remained low. According to the World Bank, *"Basic needs poverty rates showed higher poverty in Zanzibar than in Mainland Tanzania, but poverty measures based on the international line revealed lower poverty in Zanzibar. Official national poverty measures were respectively 28.2 percent in Mainland Tanzania in 2012 and 30.4 percent in Zanzibar in 2015. However, using the international poverty line of*

US$1.90 per person per day, poverty appeared to be significantly lower in Zanzibar, where the international poverty rate was estimated at 43.5 percent" (WorldBank, 2017). This increased development has further resulted in the loss of fishing grounds for local fishermen and is likely to increase poverty levels amongst the local people. In turn, this has resulted in misunderstandings and conflict between various stakeholders. As previously mentioned, due to the low educational background of the majority of rural Zanzibaris, their opportunities for employment in the formal tourism sector remains low. The study by Benansio *et al.* (2016) concluded that despite increased development, this has not led to an improvement of the income generation activities of the local fishers. Furthermore, the study by Benansio *et al.* (2016) revealed that areas with the highest tourism numbers has the highest number of fishermen going out to fish every day.

A contradiction in the conclusion in the study conducted by Benansio *et al.* (2016, p. 104) stated that "the introduction of tourism along the coastal villages of Zanzibar Island has nothing to do with the steady increase in the number of local fishers, since fishing as an activity in the Western Indian Ocean has a long history."

In another study conducted by Mkenda and Folmer (2001) to assess the maximum sustainable yield of artisanal fishery in Zanzibar, it was revealed that Zanzibar is biologically overfished. The then, annual catch of fish in Zanzibar was around 10,000 tons while the estimated potential annual yield was considered to be 25,000 to 30,000 tons (FAO, 1991). So, the belief is held that fishery offers an alternative for economic development in the area. Related to this is the notion that fishery in Zanzibar is characterised by a strong decline in the catch: from over 20,000-tonnes in mid-1980s to about 10,000-tonnes throughout the 1990s. The government believes that the decline in the catch is as a result of poor and inadequate fishing gear rather than over-fishing.

The government has thus been engaged in importing fishing gear, granting tax exemptions to all such imports, extending credit to fishermen and seeking external finance in a bid to boost the fishery sector (Jiddawi, 1990). However, Lyimo *et al*. (1997) argues that while there have been fluctuations, the overall picture is that of an increase in all components of effort rather than a decline. In particular, there has

been a 127% increase in the number of motorised fishing vessels between 1985 and 1997.

2.6 LESSONS TO BE LEARNED FROM SOUTH AFRICAN CASE STUDY

The post-apartheid South African Government has relied on Individual Transferable Quota-based (ITQ-based) fisheries management as part of a range of reforms designed to broaden access to fisheries, particularly for marginalised groups like artisanal and small-scale fishers (Raakjær-Nielsen & Hara, 2006; Hara *et al*., 2007; Isaacs, 2011). ITQs were adopted in the late 1980s in South Africa in response to adapting the fishing capacity to resource availability. Instead of focusing on conservation and community welfare or equity, ITQs focus on access rights or privileges and concentrates on promoting economic efficiency (Copes & Charles, 2004; McCay, 2004; Sumaila, 2010).

The South African case study was chosen to highlight the ways in which the lack of inclusion of indigenous knowledge may result in the implementation and mismanagement of the fisheries industry in Zanzibar, much like that which has occurred in South Africa. It aims to draw on experiences by artisanal South African fishermen of the effects the introduction of a quota system has had on their livelihoods.

The allocation system afforded elites the opportunity to benefit from the fisheries industry at the expense of communities and the marginalised bona fide small fishers, who were supposed to benefit from transformation (Isaacs, 2011). The introduction of the ITQs resulted in many small-scale fishers leaving without fishing rights and hence, they no longer had income generating activities and they had lost access to the sea. Others were able to exist by working for rights holders in certain sectors at various times of the season, but often had no income during other times of the year (Sunde, 2006).

The small-scale Fisheries Policy defines small scale fishers as *"*persons that fish to meet food and basic livelihood needs, or directly involved in harvesting/processing or marketing of fish, traditionally operate on near shore fishing grounds, predominantly employ traditional low technology or passive fishing gear, usually

undertake single day fishing trips, and are engaged in the sale or barter or are involved in commercial activity (DAFF, 2012). This is further backed up by the findings of the study by Jiddawi and Öhman (2002) which stated that, in addition to the fishermen, the fishery also supports a large number of people processing and selling the fish, as well as others who make and repair boats and gear. The contribution of marine fishery to the GDP varies between 2.1-5.0% for the Tanzania mainland and 2.2-10.4% in Zanzibar in the last 10 years.

Artisanal fishermen of South Africa are very similar to artisanal fishermen of Zanzibar in that the fishers and contract workers have few assets and are capital poor, with low numeracy and literacy skills. They also fit into conceptualisation of vulnerability of Hogan and Marandola (2005), as being socially disadvantaged and thus products of poverty. Vulnerability, then, can be expressed as a restriction of rights, whether economic, political or social. It is here that poverty and social exclusion come together, with the restriction of the right to dignity, health, decent housing, respect, political participation, representation, speech, and to be heard. This definition is very similar to that of an artisanal fisherman of Zanzibar, although the waters in which the fishing takes place, as well as the geographical context, is different, the definition of an artisanal fishermen remains the same.

This means that a basket of species may be harvested or caught within designated areas. The basket allocated to the small-scale community-based legal entity will depend on quantity of the marine living resources available in the total allowable catch (TAC), zonal allocations and total allowable effort (TAE). Both need to be taken into account alongside the socio-economic needs in the community. The criteria for the allocation of a multi-species basket (MDT & TBTI, 2014, p. 163) will depend on:

a. The availability and productivity of the specific species in the demarcated area;
b. The geographic availability of migratory species (for example, snoek and yellowtail) and the TAE of that species. Migratory species will not be allocated to a specific community-based legal entity, but it will be allocated across the boundaries of small-scale fishing community areas;
c. The extent to which the resources are sedentary and migratory and can be sustainably exploited;

d. The extent to which the particular resource is already being exploited in terms of the long-term rights allocation process;

e. The availability of certain species where the TAC is made up of zonal allocations, taking into consideration the allocations to the other sub-sectors to ensure the zonal allocation does not exceed the TAC;

f. The nature, extent and history of traditional fishing in the area.

This extract from the *Small-Scale Fisheries (SSF) Policy handbook* highlights the ways in which indigenous knowledge has not been considered into policy formulation. The policy does not take into account, environmental and biological factors that may dictate the way forward for a more integrated policy. By including indigenous knowledge, migratory, breeding and feeding patterns of targeted species, a more sustainable resource usage approach can be adopted. In theory, the SSF Policy Handbook states that the responsibility of managing these resources would be shared between the local community and the government (fisheries department). This means that fishers of small-scale fishing communities would be included in the development of management plans.

Co-management requires sharing of management decisions with the fishing communities. Each will have specific rights and responsibilities. However, based on experience whilst being involved in the South African fishing industry from a young age, the co-development between communities and government has not materialised, with more often than not, the voices of the locals are not heard. This gives rise to the question as to whether Zanzibar will follow the same route as the South African fishing industry.

An investigation into community fishing practices around Mnemba Island could possibly reveal gaps in knowledge, as studies conducted for the Island with regard to fishing practices and remaining fish stocks are basically non-existent. A literature search on the topic revealed that studies conducted around Zanzibar and Tanzania are in abundance, however, studies specific to Mnemba Island are but a few. It is imperative that research is done to assess current fishing practices and species of fish targeted by fishermen, and whether the increase in tourism in the Zanzibar region, with a focus on Mnemba Island, has had a detrimental impact on both the

natural receiving environment and on the livelihoods of the people who depend on the environment for their very survival.

2.7 SUSTAINABLE LIVELIHOOD APPROACH

> *Poverty and degradation of ecosystem services are prevalent features of the livelihood insecurity of coastal communities. Livelihood diversification is typical in coastal rural areas and it is increasingly important to identify opportunities for income generation and ways to alleviate poverty. Sustainable enterprises provide a strong tool for livelihood development but are still unable to find pathways towards development of ecosystem services and sustainable enterprises in coastal communities in Zanzibar*. (Jayaweera, 2010, p. 217).

The concept of livelihood is commonly used to describe different ways the people obtain an income for their survival (Jayaweera, 2010). A livelihood is not just people doing some activities for survival, but encompasses vulnerability context (risk factors) and policy and institutional context (government structure, authority, laws and right, democracy and participation) which conduct livelihood efforts (Ellis & Allison, 2004). Environmental factors, such as climate change, can alter people's livelihoods and this needs to be adopted into future planning and disaster risk management.

Developing regions such as Zanzibar face a multitude of exacerbating factors which leads to stressors that interact with the impacts of climate change (Niang *et al*., 2014). Structural issues, such as high levels of poverty, low levels of development, high unemployment and limited livelihood options and a lack of basic services, are some of the factors that undermine the ability of people in Small Island developing states to adapt to climate change. Examples of current stressors on livelihoods include a decline in natural resources, such as fisheries, and agricultural challenges including competition with other land uses. The changes in climate and sea level have various impacts on different sectors of the economy. For instance, rain-fed agriculture and livestock production, which, along with fishing, form the basis of food security in Zanzibar, have been affected by an increasing frequency of dry spells and by coastal floods on arable land (Sultan, 2011).

According to the study by Jayaweera (2010), in terms of livelihood diversification in Zanzibar, tourism and fishing are the most important sectors and offer more opportunities to generate higher income for households. However, livelihood management strategies need to take into account the current state of ecosystems and ecosystem services in order to identify possibilities to enhance livelihood opportunities. Increased pressure on marine resources to provide sustenance for a growing population places a great burden on the ocean to provide resources. The fisheries industry in Zanzibar has of recent years incurred increased pressure due to the growing tourism industry and this has placed a burden on marine resources. The demand for larger species of fish for consumption by tourists has led to a cascading effect in the way that most of the larger species of fish are sold to markets for tourist consumption, thus leaving reef fish for consumption by local Zanzibaris.

The common trend of fisheries is to remove larger, more economically viable fish before switching to smaller species, causing long-term changes to fish community structure. Reef fish provide essential protein and income for many people, and the impacts of commercial and high-intensity subsistence fishing on reef fish are well documented. However, the response to low levels of artisanal fishing on fish communities is less understood (Martin *et al*., 2017).

In small less developed countries, many people rely on fish for food, which is often caught using traditional subsistence means, with these fishers frequently using traditional equipment (often without modern fishing technology), catching fish from all trophic levels, whilst rarely specifically targeting top predators (Dalzell, 1996; Glaus *et al*., 2015). Reef fish are the primary source of protein for millions of people that live on tropical islands and coral atolls, and reefs provide 10% of all fish consumed by humans (Moberg & Folke, 1999; Albert *et al*., 2015).

> *The majority of studies, however, have not differentiated between small-scale artisanal fishing (small commercial operations fishing for profit), and subsistence fishing (fishing only for food, no monetary incentive to capture or refrigeration to store excess fish) that is still practised by many small coastal communities. A potential reason for this is the difficulty of quantifying fishing effort for coral reefs, it can be hard to tell if people are fishing for food, local barter or in small-scale commercial operations."* (Teh *et al*., 2013, p. 2).

The study by Martin *et al.* (2017) aimed at assessing the ways in which commercial and subsistence fisheries differ and how they affect coral reef systems. The study concluded that that subsistence fishing by a small community using traditional gear does not dramatically alter the biomass or trophic composition of reef fish assemblages from a near-pristine state or result in cascading ecosystem-level effects that are routinely associated with commercial harvesting of top predators.

Taking cognizance of the paragraph above, a question needs to be asked. Is Zanzibar moving away from a subsistence-based fishery to a more commercialised fisheries sector? The reason for this could be attributed to the growth of tourism in Zanzibar and in the coastal communities. The increased demand for marine resources may result in a shift from artisanal fishing methods to more destructive fishing methods. The reasons for this are that, the majority of Zanzibaris are indigent, often living from hand to mouth and the prospect of earning a higher income through selling fish to tourist hotels that could drive fishermen to adopt unsustainable fishing practices. The study by Benansio *et al*. (2016, p. 106) concluded:

> *The introduction of tourism along the Coast of Zanzibar Island has both positive and negative impacts on the activities of the local fishing households. The development of new tourism infrastructure, such as construction/building of new resorts/hotels on the beaches area has restricted of local fishers accessing their respective fishing grounds, had affected the income generating activities of their households. The living conditions of local fishers along the coastal villages of Zanzibar Island remain poor with almost no changes over the past twenty years of introduction of tourism development.*
>
> *Although the introduction of tourism has diversified the livelihoods of local fishers, the participation of local fishers' households in ecotourism and tourism-related activities were less significant as a result of poor educational background of the majority of local fishers' households. In addition, the advent of tourism development in the coastal village has benefited the local fishers as their households' income because of new markets being created for fish and seafood high in the resorts/hotels. The new market created after the development of tourism in the coastal villages has encouraged many households in the rural areas of Zanzibar to venture into the business of the fishery industry.*

The *Zanzibar Vision 2020* aims at promoting sustainable tourism and including environmental concerns and resource management at its core. It aims to develop a tourism industry which is culturally and socially responsible, ecologically friendly, environmentally sustainable and economically viable. This further entails the conservation of its natural marine resources, which is arguably its largest tourist attraction.

2.8 FISHERIES AND TOURISM ECONOMICS IN ZANZIBAR

The overall goal of *Zanzibar Vision 2020* is to eradicate absolute poverty in the society through many of its visions that include, the promotion of sustainable tourism and the promotion of sustainable fishing. In Zanzibar, poverty is considered the greatest burden for the people and it is not merely the lack of income that determines poverty, it is also the lack of accessibility to the basic needs of the people. The eradication of poverty requires sound macro-economic policies aimed at creating employment opportunities; education and training that will promote sustainable livelihoods through freely chosen productive employment and work; and basic social services, including health facilities.

One of the objectives of the *Zanzibar Vision 2020* is to diversify the economy through modernisation of agriculture, tourism, fishing and the strengthening of industry, internal and international trade sectors. It further aims at promoting sustainable fishing for domestic consumption and for export, thereby increasing its contribution to the Zanzibar GDP. The points below outline the *Zanzibar Vision 2020*'s fishing development objectives.

- Utilise the existing fishing potential efficiently and ensure ecological balance through establishment of community-based management areas for marine resources and development of professional groups, joint-venture, partnership and cooperative associations relevant to the development of fishing activities;
- Promote public awareness on the scenic value of marine habitats;
- Establish aquaculture activities;
- Improve international competitiveness by providing incentives, supportive market research and extension services to fishermen;

- Prepare and disseminate a code of fishing practice and processing methods, which allows for health, safety handling, storage, marketing and environmental concerns;
- Encourage foreign and domestic investors to establish large scale, deep-sea fishing business and fish processing factories.

The objectives above highlight the ways in which Zanzibar may be moving away from a subsistence artisanal-based fishery to a more commercialised fishery. However, the vision can be considered to be merely a vision, as the situation on the ground with regard to fishing practices differs vastly. Although there have been improvements in technology for fishermen, with the availability of motorised boats in order to access deeper fishing waters, the majority of the rural fishing population still rely on very basic artisanal vessels and fishing methods.

Thirty-five years ago, the economy of Zanzibar was one of a different nature where local Zanzibaris had unlimited free access to the coast and all its marine resources through artisanal means. However, in 1985 Zanzibar embarked on concentrating on its tourism industry and annual tourist arrivals increased from about 19,000 to 219,000 (Lange & Jiddawi, 2009). This has placed greater pressure on fishermen to catch fish in order to satisfy the increased demand created by the growing tourism market. As a result, the number of fishermen has increased and coupled with other socio-economic issues and the lack of basic education has led to many people turning to fishing and the collection of marine resources by foot as their only form of income generation.

There is great variation of income among different fishers, as many fishers do not have access to any vessel and are limited to fishing by foot along the shore. The majority of foot fishers are women who mainly collect for edible shellfish along the intertidal zone, which does not generate high incomes. Women in Tanzania are not active in the fishing sector with regard to hand line, net, dema trap or spear fishing, however, their role in other fishing activities is significant. Their 'fishing efforts' are usually restricted to the littoral active zones where, between tides, they collect shellfish and octopus using metal rods and long wooden sticks amongst other makeshift methods (Jiddawi & Öhman, 2002).

There is no information about downstream fishing-related activities, such as processing and marketing to the different market segments – local household consumption, local restaurants, and restaurants and hotels mainly serving foreign tourists. Concerns have been raised regarding those who benefit down the value chain, especially those involved in fishing-related activities, such processing and packaging of marine products. The reality is that the middle men supplying the tourist hotels with marine products, benefit the most in terms of monetary benefits and the fishermen are those who actually benefit the least (Lange & Jiddawi, 2009). The artisanal fisheries in Zanzibar operates very much like that of the South African example, whereby the owner of a boat, the captain and the crew, and payment is most often a share of the catch (Lange & Jiddawi, 2009).

Following population increases, changes in technology, the changing world economic system, and the increase in tourism in Zanzibar, the demand for fishery resources has been increasing gradually. This has resulted in an increase in fishing pressure and has driven the fisheries industry to adopt destructive fishing methods, such as dynamite fishing and the illegal use of gill-nets. Most of the destructive methods are prohibited by law, but continue to be used due to lack of surveillance, enforcement and public awareness.

Habitat degradation poses serious threats to reef fish in particular, since reef fish live in close association with structural features, such a coral (Berg *et al*., 1998; Öhman & Rajasuriya, 1998). Negative environmental impacts in the form of habitat degradation may result in secondary effects on fish stocks, thereby decreasing numbers and potentially compromising the sustainability of fisheries. (Öhman et al., 1997). A key issue that needs to be addressed is the extent to which coastal communities are involved in marine conservation, as often, local coastal communities and tourism are in competition for the benefits which can be derived from the ocean. Overall, Zanzibaris obtain 47% of tourism GDP, but only 20% accrues to local communities; the greatest majority goes to government in the form of fees and taxes (15%) and to Zanzibaris from outside the local communities (12%). Non-Zanzibaris (from mainland Tanzania and other countries) obtain 53% of tourism GDP, but this distribution varies a great deal among different categories of tourism (Lange & Jiddawi, 2009).

The study by Lange and Jiddawi (2009) concludes that, in order to involve local communities to become more active in the distribution of wealth with regard to tourism, the following needs to be done.

- ***Investment in education and training*.** The high-value international tourism industry requires high levels of training and fluency in at least one foreign language. Many Zanzibaris do not receive adequate education at the primary and secondary levels, making them less able to take advantage of the tourism training programmes offered by government and private organisations. Greater employment in more skilled, better paid occupations in tourism requires more investment in education, as well as post-secondary school tourism training, so that it is equivalent to education obtained in mainland Tanzania, from where many tourism workers presently come.
- ***Investment in basic infrastructure*.** Many tourists express dismay at the state of the airport, roads, unreliable electricity supply and poor solid waste management. High-end tourism requires adequate infrastructure and maintenance of that infrastructure. Investment in improved waste water treatment and solid waste management would have the added benefit of improving the health of coral reefs, especially around Zanzibar Town (ACRA, 2008; ZATI, 2008).

Fisheries and Tourism in Zanzibar cannot be discussed as separate issues. The two are intermingled with each other as the effects of one is felt by the other. Furthermore, in order to diversify the Zanzibari economy requires capital investment in the training of local people to become more skilled in other facets of income generation rather than fishing, thereby reducing pressure on marine resources. *Zanzibar Vision 2020* aims to eradicate poverty through a few objectives of which two, which are relevant to this study are:

- Promote a sustainable and internationally recognised tourism industry;
- Promote sustainable fishing.

The promotion of sustainable tourism needs to take into account the needs of the local people and provide the necessary training and education to afford local Zanzibaris the opportunity to work in the industries. Environmental degradation and marine resource depletion must be considered when drafting policies and

programmes to promote tourism, as the tourism industry in Zanzibar would collapse without its rich marine ecosystems. This goes hand-in-hand with the adoption of sustainable fishing practices. Despite the majority of fishermen on Zanzibar currently only adopting passive fishing gear, *Zanzibar Vision 2020* aims to encourage foreign and domestic investors to establish large scale deep sea fishing business and fish processing factories. Without the necessary studies undertaken, it may lead to potential negative impacts on the marine ecosystem in terms of environmental and resource depletion.

2.9 CONCLUSION

This chapter introduced the reader to the importance of coral reefs and coral reef fish and the ways in which it plays a vital role in the ecosystem. It also highlighted that effective fisheries management must be adopted and that a balance must be established between sustainable fisheries and survival of these complex coral reef ecosystems. The South African industry and the way in which a shift from artisanal fishing to commercialised/regulated fishing and impacts on the livelihoods of the indigenous people was examined briefly. The *Zanzibar Vision 2020* was presented and its objectives relative to this study were highlighted. This was followed by a discussion on the sustainable livelihoods approach. The chapter concludes that for the *Zanzibar Vision 2020* objectives to be achieved, integrated resource management and planning must be adopted into the planning level prior to implementation.

Chapter 3
RESEARCH DESIGN AND METHODOLOGY

> *By conducting research, researchers attempt to reduce the complexity of problems, discover the relationship between seemingly unrelated events and ultimately improve the way we live.* (Marczyk *et al*., 2005, p. 1)

3.1 INTRODUCTION

This chapter focuses on the research design and methodologies adopted for the study and the methods used to collect and collate the data. The three study areas are also described and discussed in this chapter, providing the reader with the geographical context of the study areas.

3.2 RESEARCH DESIGN

> *Research design not only needs to have all the required parts, it has to work – to function smoothly and accomplish its tasks. This requires attention to the connections among the different parts of the design – what I call coherence. There isn't one right way to create a coherent qualitative design.* (Maxwell, 2012, p. 246)

The research design in this study took the form of an exploratory qualitative multi-method study on a single case study with three embedded subcases. This method of research was chosen in order to gain an understanding of the situational circumstances of the fishing communities of the study areas and then to refer to literature to examine the information from an academic perspective as to why the situation is why it is.

3.3 RESEARCH METHODOLOGY

Methods and techniques used for data collection, processing and analysis were applied as follows.

3.3.1 Data collection

Interviews and informal discussions with local communities were applied. The three major stakeholders in the area being the Department of Fisheries, the private sector and local communities. Questionnaires and informal discussions were conducted to assess anthropogenic interactions in the marine environment on the part of members from both the tourism and fishing industries, as well as from MIMCA (Mnemba Island Marine Conservation Area) rangers. The interviews and discussions with the fishermen focused on the following categories:

- Types of fishing gear used;
- Types of vessels used to access fishing grounds;
- Areas of fishing; and
- Perceptions of fish stocks.

The interview schedule used for the interviews is presented in the appendices of this dissertation as Appendix A (English) and Appendix B (Swahili).

The data collection phase initially started with questionnaires which were handed out to fishermen and local villagers. A pilot phase data collection effort was initiated in order to determine whether the questions contained in the questionnaires were adequate for data collection. The questionnaires were handed to &Beyond staff working and residing on Mnemba Island. It was then found that the questionnaires were too rigid and thus the author shifted towards a more informal discussion approach in order to gather data. The reason for this is the language barrier between the author and interviewees, and also the lack of understanding of the depth of the questions being asked. It was established that the greater majority of the interviewees did not understand the questions and thus shifted the data collection to informal interviews.

The questions asked during informal discussions and interviews were focused on the history of fishing in the areas, the perception of fishermen with regard to fishing activities and the relationship fishing has with tourism and tourism development. The goal of the interviews was to gauge opinions and perceptions of fishing in the area based on questions concerning status, management, perceived problems and recommended solutions. Interviews were conducted in a semi-structured format,

which enabled the interviewees to explain perceived issues in their own way, including their feelings, thoughts and recommendations on the matter.

Convenience sampling was applied, where the researcher approached fishermen and local villagers asking whether they would be willing to be interviewed. This was done in order to gain opinions and perceptions of fishing activities and related fishing stocks of the study areas.

The fieldwork was scheduled for three time phases:

- 16 – 26 August 2015;
- 16 – 30 September 2017;
- 4 – 12 December 2018.

3.3.2 Dockside monitoring

This took the form of:

- Photographs of catches, as well as informal interviews with fishermen;
- Monitoring of fishing activities; and
- Informal conversations with local people at fish markets.

3.3.3 Secondary data

Secondary data was obtained from Mnemba Island Lodge. Two types of data were targeted, namely the fish purchased data and the occupancy data for the Lodge. Fish and octopus purchase data in the form of digital and paper records were received from the lodge chefs indicating the weights of fish bought by the Lodge. These records were then all harmonized and inserted into excel spreadsheets. The spreadsheets were arranged and used for the production of graphs to illustrate schematically the fish and octopus purchases made by the Mnemba Island Lodge. Some gaps in the data were present, due to the fact that accurate record keeping was not conducted for each month. The data which was provided was from 2013 to 2018. This secondary data was compared to the primary data collected by the author.

3.3.4 Literature control

The findings were equated with the literature using published and unpublished data to fact-check information gained through other data sources. Journal articles, situational assessments, reef surveys, MPA (Marine Protected Areas) reviews, conservation guides, descriptions of marine policy and descriptions of existing conservation projects were utilised.

3.3.5 Data processing

Interviews recorded using a cell phone were then transponded to a word document where the researcher inserted the responses to interviews of this study as verbatim. The researcher took notes whilst conducting interviews and discussions, which were then expanded upon in conjunction with data recorded using a cell phone voice recording. Furthermore, the researcher was handed information booklets from the Aquarium located in Nungwi, as well as pamphlets, notes and booklets that were received from the &Beyond Lodge located on Mnemba Island.

3.3.6 Data analysis

The results of the interviews and informal discussions focused on content analysis in order to find common themes in the data and the literature study. Furthermore, the extraction of themes was then elaborated on in the results analysis and discussion in accordance with the stated research objectives of the study.

The secondary data provided by the &Beyond Lodge, in terms of fish and octopus bought, was used to compile graphs to aid analysis and present the results. The graphs were analysed to extract data relevant to this study, such as total of fish and octopus bought per month for a period of six years, averages of fish and octopus bought and percentages of fish and octopus bought.

3.4 ETHICAL CONSIDERATIONS

Ethical clearance was received from the University of South Africa's Health Research Ethics Committee. The ethical clearance, with NHREC Registration referenced as REC-170616-051 and REC referenced as 2017/CAES/029 is attached in the Appendices as Appendix C. Names and any personal details of

interviewees were omitted to ensure that the conditions of approval of ethical clearance was strictly adhered to. Interviewees were informed prior to the interviews that full confidentiality and anonymity would be ensured. The motivation for the study, the objectives of the study and how the results of the study will be used were explained to research participants. Furthermore, verbal consent were procured from the research participants to firstly, conduct an interview and secondly to record the interview using the researcher's cell phone.

The motivation for selecting case studies for this research was based on a criteria that the study areas consist of large amounts of fishermen and extraction of marine resources coupled with high tourist activities. The &Beyond Lodge situated on Mnemba approached the University of South Africa as an attempt and step towards the development of an integrated management plan for the Mnemba Island as part of the larger proposed MIMCA conservation area. Thus, an investigation into community fishing practices would allow for more informed decision making when drafting management plans. Furthermore, following the completion of the initial mini dissertation in 2015, and after discussions with local fishermen, it became evident that the majority of the fishermen fishing in the areas around Mnemba were from the villages of Myoni, Matemwe and Nungwi and is thus the rationale behind selecting the study areas. Moreover, it must be noted that the fishermen from Myoni, fish in the waters of Matemwe and Mnemba, which provided the close proximity of Myoni village to Matemwe. Therefore, the fishermen of Myoni were interviewed together with the Matemwe fishermen.

3.5 STUDY AREA

The groups of islands which make up Zanzibar is a semi-autonomous region of Tanzania located approximately 32km off the coast of East Africa. The two largest islands are Ugunja in the south and Pemba in the north. During the 19th Century slave trade, Zanzibar was ruled by Omani Arabs (Longair, 2016). However, as of the last 20 years, the tourism industry has become one of the largest income generating ventures for the nation. The tourism industry is reliant on the natural resources of the island, with its picturesque white sand beaches fringed by coconut palms. Tourism in Zanzibar is largely dependent on the existence of the ethereal aspects of these natural resources (Miller *et al*., 2013). Taking cognisance of this,

it is evident that livelihoods and tourism are competing for natural resources. On the one hand, tourism relies largely on “pristine” beaches and reefs, while on the other hand livelihoods rely on fishing along those reefs.

The research for this study was conducted in the villages Matemwe in the northeast of Zanzibar, Nungwi in the northern peninsula and Mnemba Island located approximately 4.5 kilometers off the north-eastern coast of Zanzibar. These three coastal areas were selected firstly, as they are major fishing villages along the northeastern shore of Zanzibar and secondly, the development of tourism and tourist related activities does not take place equally along the coast and differs from one village to another. More than 25% of Zanzibar’s population depends on the fisheries industry for their livelihood (Jiddawi & Pandu, 1988). The local fishing communities who fish near Mnemba Island come predominately from the northeastern coast of Unguja Island, mostly from villages between Matemwe and Nungwi (Johansen & Kennedy, 2014). The research sites had different numbers of tourist resorts, hotels and tourism-related activities. Mnemba Island is leased from the Zanzibari government and is operated by &Beyond as a private tourist resort island.

3.5.1 Mnemba Island

Mnemba Island is situated approximately 21km off mainland Zanzibar and is characterised by a small outcrop of land with a vegetated coastline of 1.46km and an area of 0.12km^2. The entire Island is surrounded by a shallow water coral that makes up the fringing reef. Portions of this reef are considered to be among the healthiest coral reefs in the region (Muhando & Francis, 2000; Bergman & Öhman, 2001; EcoAfrica, 2005; Wagner, 2007; Zvuloni *et al*., 2010). The Mnemba atoll is an important source of tourism and a historical fishing ground for rural communities living on the north-eastern coast of Unguja, Zanzibar (EcoAfrica, 2005; Gustavsson *et al*., 2014). Presently, there is a luxury ecotourism lodge on Mnemba Island that is leased from the Zanzibari Government by &Beyond, an ecotourism operator operating various lodges across Africa. The lodge located on Mnemba currently has 12 bandas and can house up to 24 guests at any given time.

With the establishment of the &Beyond Lodge and zonation restrictions of the MIMCA, a 200m-exclusion perimeter was set around the island, excluding all persons and boats aside from Mnemba Lodge guests and employees. The MIMCA encompasses several reefs surrounding the island (Johansen & Kennedy, 2014). The fringing reef consists of eleven individual reef sites, including the House Reef and Kichouani Reef. The House reef lies immediately on the western side of Mnemba Island. The 200m no-access perimeter encompasses less than half of the House reef, but a strict no-fishing restriction is in place on the entire reef. The reef is predominately used by &Beyond Lodge guests and local freelance tourist operations that frequent the reef with snorkelers. The Kichwani Reef lies approximately 1km to the south of Mnemba Island. Kichouani Reef is also frequented by tourist operators and fishermen from local villages. During low tide, fishermen walk on shallow or exposed reef collecting their catch (Johansen & Kennedy, 2014).

3.5.2 Matemwe

Matemwe is situated on the eastern coast of Zanzibar Island with a continuous band of reef, which makes up the fringing reef that spans the coastline. Fringing reefs occur as a continuous band, with the reef crest acting as a wave break, dissipating most of the wave energy (Masalu, 2000). Matemwe is a moderately populated tourist village with approximately 110 tourist hotels, guesthouses and bungalows (Benansio *et al.* 2016).

Photograph 3.1 Local fish market on Matemwe beach

According to the interviews conducted in 2015 and 2017, it was ascertained that the majority of the fishermen from Matemwe utilise the reefs surrounding Mnemba as their fishing grounds (Photograph 3.1). The reasons as to why they use these reefs are two-fold. Historically, these are the areas that have always been used for fishing by the local Matemwe fishermen who are familiar with these reefs. Secondly, the vessels used by the fishermen limit them from accessing deeper waters (Photograph 3.2).

Photograph 3.2 Fishermen hunting for octopus along the fringing reef stretching along coastline of Matemwe village

3.5.3 Nungwi

Nungwi is situated on the northern tip of Zanzibar Island and is by the most densely populated tourist area in Zanzibar (Figure 3.1). The topography is Nungwi consists of coral line lands reaching very close to the beach across most of the shoreline. Except for the original settlement, which is sandy and flat, the land rises quite rapidly to 20m above sea-level with the natural bushes covering most of the remaining parts of the land (ZILEM & FINNIDA, 1993). Nungwi is mostly a tourist village. It has more than 250 tourist hotels, guesthouses and bungalows.

During data collection, it became clear that Nungwi is a major fishing village and often the local fish market supplies a large variety of fresh fish daily to the more than 250 hotels situated within the area and, having said this, the main economic activities are connected to fishing and tourism. The average district income per

capita is US$229 per year (Labayka Development Fund, 2012). Approximately 7500 villagers inhabit Nungwi and, as the first coastal tourist destination in Zanzibar, the village has experienced a large share of labour-induced immigration from other areas of Zanzibar and Tanzania mainland to the Nungwi area.

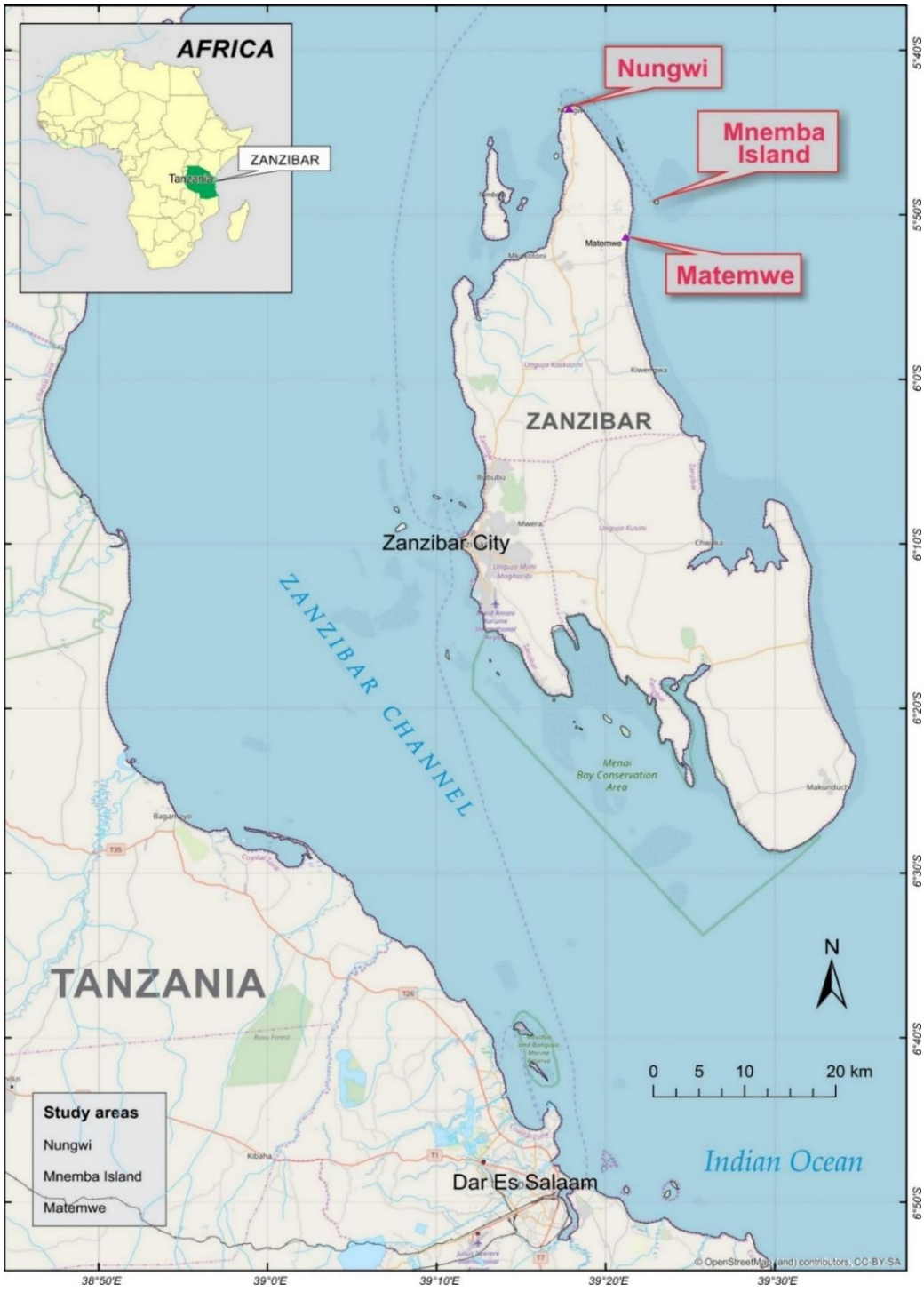


Figure 3.1 Map of Zanzibar showing the villages of Nungwi, Matemwe and Mnemba Island in relation to one another and mainland Tanzania

Figure 3.2 Larger scale map of Zanzibar showing villages of Nungwi, Matemwe and Mnemba Island in relation to one another

The study areas occurring on the eastern coast of mainland Zanzibar are Mnemba and Matemwe, with Nungwi occurring on the northern eastern tip of the mainland (Figure 3.2). The three areas were chosen as they all have differing characteristics, with Mnmeba being a privately leased island, Nungwi being the most popular tourist village and Matemwe being a moderately populated tourist village. However, all three study areas are areas where there is high fishing activity and marine resource extraction, with the exception of resource extraction along Mnemba's coastline. Furthermore, fishermen from the villages of Matemwe and Nungwi fish along the same reefs occurring in the vicinity of Mnmeba, however despite this, majority of the Nungwi fishermen do not sell their catches to Mnmeba Island Lodge, whereas a vast majority of Matemwe fishermen sell their catches to the Lodge.

3.6 CONCLUSION

The chapter focused on the research design and methodologies applied to the study. Informal discussions and interviews were held with various local people to gather their perceptions and indigenous knowledge and to record their insights as conveyed in this dissertation. The three study areas were identified and a locality map was provided to display the study areas in relation to one another. The results, evidence and findings of the study will be discussed in the next chapter.

Chapter 4
ANALYSIS OF RESULTS AND DISCUSSION

Wild fish stocks are of enormous importance to economic output, livelihoods and food security. If degraded fisheries are rebuilt and sustainably managed, they can make an even larger contribution. Beyond the direct economic, social and food security benefits to be gained from rebuilding fisheries, the transition to sustainable management is likely to make marine ecosystems more resilient to external stresses, including those stemming from climate change and pollution. Fisheries are vital components of ecosystems, and healthy ecosystems are key to the continued productivity of fisheries. (International Sustainability Unit, 2012).

4.1 INTRODUCTION

Wild fish stocks are of enormous importance to economic output, livelihoods and food security. If degraded fisheries are rebuilt and sustainably managed, they can make an even larger contribution. Beyond the direct economic, social and food security benefits to be gained from rebuilding fisheries, the transition to sustainable management is likely to make marine ecosystems more resilient to external stresses, including those stemming from climate change and pollution. Fisheries are vital components of ecosystems, and healthy ecosystems are key to the continued productivity of fisheries (International Sustainability Unit, 2012).

This chapter will provide the results of the study, as well as the analysis and discussion. The results are structured according to the objectives of the study, namely:

- Assessing which species of fish are most targeted by fishermen and which species of fish are most sought after for the market;
- Assessing current fishing practices and methods;
- Investigating the implications of destructive fishing;
- Providing recommendations for the improvement on sustainable fishing.

4.2 RESULTS

In 2015, the author spent a total of 11 days on Mnemba Island, where numerous interviews and informal discussions were held with &Beyond Lodge staff. Informal talks and discussions were held with fishermen and locals on Matemwe beach and at Stone Town fish market. In 2017, a further 12 days were spent in Matemwe where interviews were held with local fishermen and fishmongers. This was followed in 2018, with 10 days spent in Nungwi village where interviews were conducted and several informal discussions with fishermen, fishmongers and an employee at the aquarium located on Nungwi beachfront.

This section addresses Objective 1 of the study that aims to assess which species of fish are most targeted by fishermen and which species of fish are most sought after for the market (local market, as well as the Mnemba Island Lodge). Furthermore, this section investigates whether there is a rising trend for specific types of fish due to the increase in demand associated with the tourist market.

4.2.1 Interview with Lodge chef

An interview was conducted with the lodge chef in order to gain an understanding of how the Lodge operates, in terms of its fish and octopus purchases. This was done in order to find if there is a correlation between certain species of fish that the Lodge buys and if it has an influence on the species of fish targeted by the fishermen to partially fulfil Objective 1 of the study. The chef can be considered to be the primary data capture regarding all fish and octopus being bought by the Lodge.

The chef stated that large fish over 25kg is not purchased by the Lodge due to the possible presence of *Ciguatera*[1]; a foodborne illness present in some fish, which consume reef fish occurring around Mnemba Island. Furthermore, Mnemba Island Lodge, being situated in a conservation area, does not purchase Bluefin Tuna or Blue-Jack as the Lodge has a strict policy of not buying any reef fish. Most of the fish bought by the Lodge is procured from local fishermen of the surrounding

[1] Ciguatera fish poisoning occurs after eating reef fish contaminated with toxins, such as ciguatoxin or maitotoxin. These potent toxins originate from small marine organisms (dinoflagellates) that grow on and around coral reefs. Dinoflagellates are ingested by herbivorous fish, and the toxins are concentrated as they pass up the food chain to large (usually >6 pounds) carnivorous fish and finally to humans. Toxin in fish is concentrated in the liver, intestinal tract, roe and head (Acosta & Balaban, 2009).

villages, who bring their catch to the Lodge. One of the reasons, which many of the fishermen are in favour of selling to the Lodge, is due to the higher price premium paid by the Lodge compared to the prices of fish the fishermen would be offered at the local fish markets located in their respective villages. The Lodge buys fish all year round for consumption by lodge guests, as well as lodge staff (Table 4.1). A Matemwe fisherman mentioned the following:

> *I like in to catch the big fish to sell there at Mnemba because they pay the good price for the big fish. I am going to catch by the reef there by Mnemba, where my father took me for many years. The reef the name is, Kichouani and Small Wall and the Big Wall. There is many fish there. For many years I fish there.*

Table 4.1 Common fish bought by Lodge

Common name	Scientific family name
Snappers	*Lutjanidae spp.*
Jackfish	*Caranx lugubris*
Spanish Mackerel	*Scomberomorus maculatus*
Cobia	*Rachycentron canadum*
Dorado	*Coryphaenidae spp.*
Barracuda	*Sphyraena spp.*
Yellow-fin Tuna	*Thunnus albacares*
Octopus	*Octopus vulgaris*

The chef provided written notes and excel spreadsheets of total fish weights bought by the Lodge. However, the data provided does not state the species of fish bought, so a comparison as to which species are most commonly sold to the Lodge, is not available. Some of the data provided for the years 2013 to 2015 are inconclusive, as fish purchase data is not available for each month.

From the data provided, it was noted that in early 2015, the Lodge paid 6500 Tanzanian shillings/kilogram of fish and 5500 Tanzanian shillings/kilogram of octopus. However as of mid-2015, a consensus amongst the local fishermen resulted in a rise in fish prices to 8000 Tanzanian shillings/kilogram of fish and the octopus price remained steady at 5500 shillings/kilogram. Seasonal occupation of Mnemba Island determines the amount of fish bought by the Lodge. The Lodge is able to purchase approximately 30-40 kilograms of fish and octopus per day, with a

total freezer storage space of up to 60 kilograms of fish and octopus. According to the lodge chef, approximately 30% of the total weight of fish and octopus bought by the Lodge is wastage in the form of intestines, heads, fins, tails, etc. and the larger majority of octopus bought is for staff consumption. The Lodge provides all staff working at the Lodge with three meals per day, which includes 60 Staff, 4 MIMCA patrol officers and any casual or contract workers. The Lodge can accommodate a maximum of 24 guests at any one time period.

Of all the meals consumed by guests, approximately 90-95% of the meals are seafood. The lodge chef stated that the average amount of fish and octopus consumed collectively by lodge staff, as well as guests, is approximately 15kg per day. In 2015, the operating budget for fish purchases was 4 million Tanzanian shillings per month for fish and octopus, with a general split of 50/50 for lodge staff and guests. The data revealed that the prices of fish has increased by approximately 500 Tanzanian shillings per year since 2013, with the price as of 2015 being 8000 shillings/kilogram of fish. According to the chef, between October and December of 2013, there was an increase in the number of Dorado being caught and sold to the Lodge. It was also noted by the researcher that in December of 2018, the amount of Dorado being caught and sold at the local fish market in Nungwi was very high, with daily catches of Dorado exceeding those of any other species being caught during this time period. However, during October to December of 2014, the numbers of Dorado being caught and sold to the Lodge decreased substantially. The chef did not know the reason for this.

From the interview with the lodge chef, as well as through participant observation during data collection the only species of fish being sold to the Lodge includes larger predatory species, such as Barracuda, Yellowfin Tuna and Kingfish. Based on observations and through discussions with local fishermen, it is safe to assume that all species of fish are caught, this includes reef fish and predatory fish. However, the fishermen only sell the larger species of fish to the Lodge.

This concludes and confirms Objective 1 of the study which aimed to assess which species of fish are most targeted by fishermen and which species of fish are in highest demand form the local market, including hotels and the Mnemba Island Lodge.

4.2.2 Data provided by Lodge

In Table 4.2, a comparison is shown between the total weights of fish and octopus bought by the Lodge for staff and guests respectively. However, the results were not conclusive, as there is data missing for some of the months in 2013. The 2014 results can be considered to be fairly accurate as there was a stock-take on the amount of fish bought for each month, except for the month of March for which no data was available. The data provided for 2015 is conclusive, as the purchase data was recorded for each month. In the data for 2016 there is missing data for the month of June. The data provided for 2017 and 2018 is conclusive as purchase data was recorded for each month of the year.

Table 4.2 Kilograms of fish and octopus purchases by Lodge for guest and staff consumption for 2013

Month	Fish staff (kg)	Fish guests (kg)	Octopus staff (kg)	Octopus guests (kg)
January	228	189	0	0
February	224	328	0	0
March	364	457	77	0
April	64	78	12	0
May	112	143	14	0
June	194	210	36	0
July	199	287	75	0
August	90	230	187	0
September	133	286	230	2
October	154	315	184	0
November	0	0	0	0
December	0	0	0	0
Total	**1762**	**2523**	**815**	**2**

Figure 4.1 below illustrates the monthly purchase of fish and octopus by the Lodge for the year 2013. Data are missing for the months of November and December.

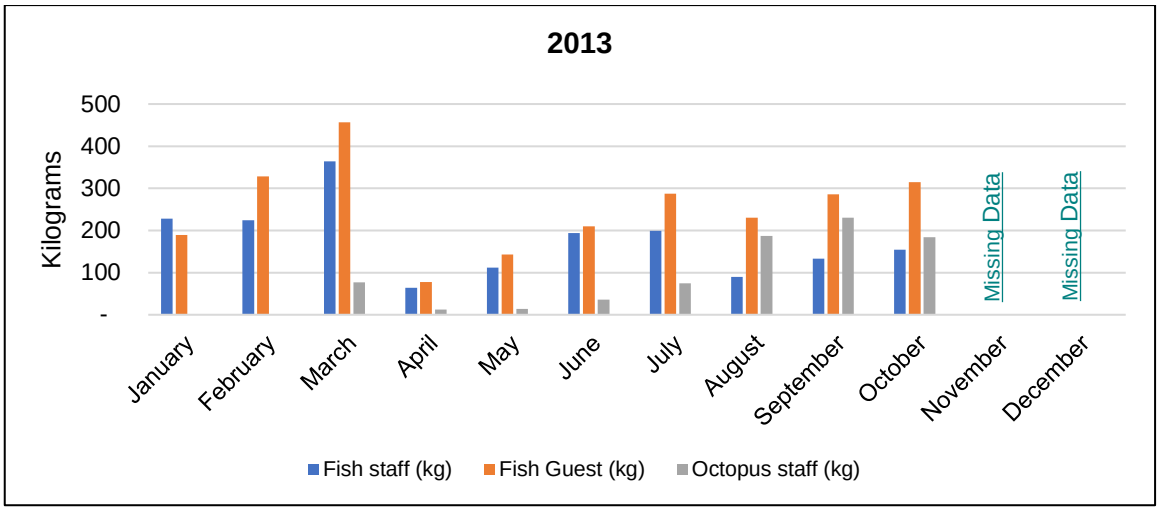


Figure 4.1 Monthly purchases of fish and octopus for guest and staff consumption for the year, 2013

A possible reason for the increase in purchases for March can be attributed to the fact that the Lodge closes from April to May (although a small security and maintenance team remain on the island). It can be assumed that to account for the perceived decline in fish sales to the lodge, fishermen sold more of their catches to the Lodge. No data was available for the months November and December. Except for September, there were no recordings of any octopus being purchased for guest consumption. Figure 4.2 represents the total percentage of fish and octopus by weight purchases. When reviewing the graph above, it can be seen that the majority of fish bought by the lodge is for guest consumption. Of all the octopus purchased by the lodge, none was for guest consumption.

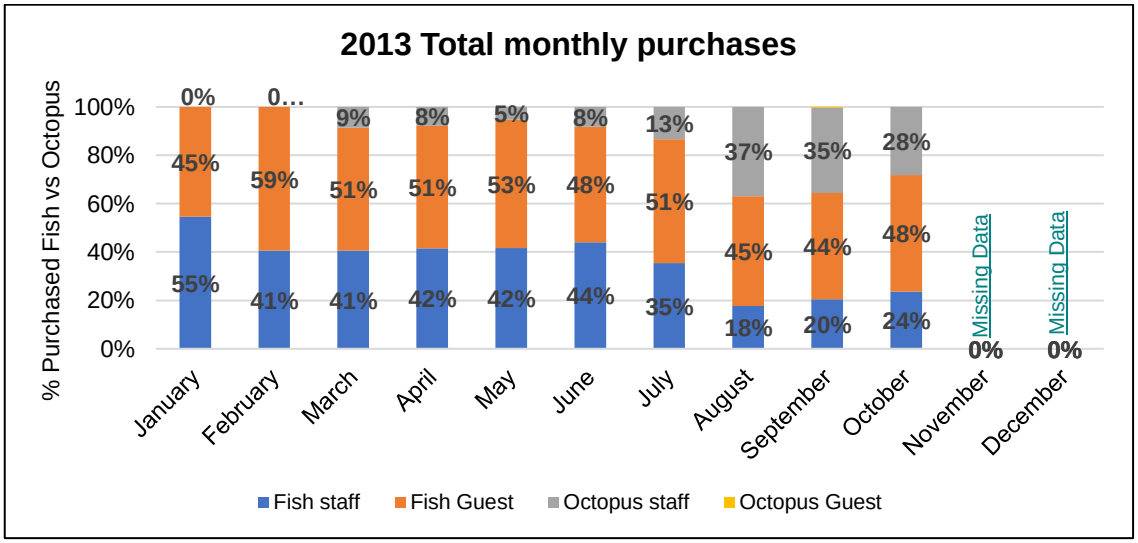


Figure 4.2 Percentage of fish and octopus by weight purchased for guest and staff consumption for 2013

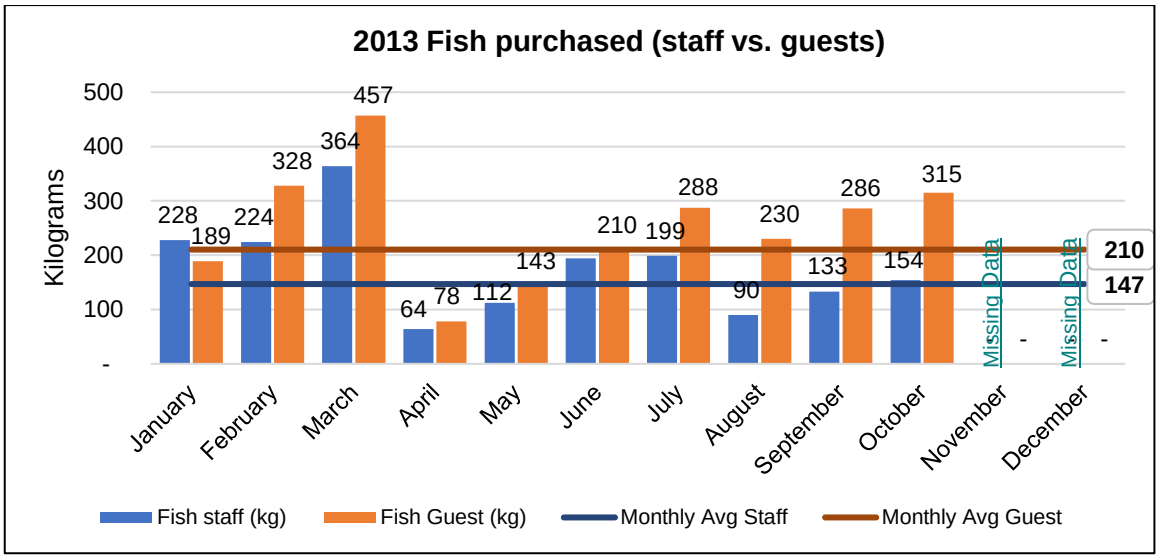


Figure 4.3 Monthly totals of fish purchased for staff and guests for 2013

Figure 4.3 above represents the total fish purchases for the Lodge for both staff and guest consumption and the two lines indicate averages. The graph depicts that for months of March, July, September and October, the Lodge purchased above average amounts of fish for guest consumption. The average weight of fish purchased per month for guests is 210kg vs. 147kg for staff.

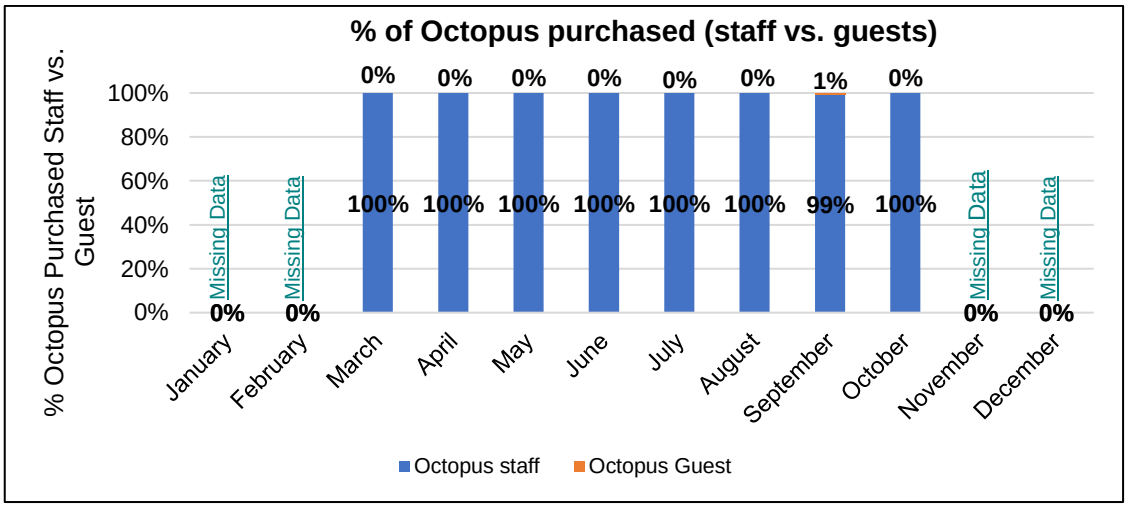


Figure 4.4 Percentage of octopus purchased for both staff and guests for 2013

Figure 4.4 depicts the total percentage of octopus purchased by the Lodge for both staff and guest consumption. However, 100% of all octopus purchases was for staff consumption, except for the month of September where 1% of the total octopus purchases was for guest consumption. Table 4.3, shows the total weight of fish and octopus bought by the Lodge in 2014 for staff and guest consumption.

Table 4.3 Total weight of fish and octopus purchases by Lodge for guest and staff consumption for 2014

Month	Fish staff (kg)	Fish guests (kg)	Octopus staff (kg)	Octopus guests (kg)
January	80	164	81	0
February	212	342	147	0
March	0	0	0	0
April	60	45	15	0
May	91	92	103	0
June	325	184	17	0
July	242	278	282	0
August	269	303	254	0
September	329	368	18	0
October	419	396	158	0
November	389	492	126	0
December	360	255	112	0
Total	**2776**	**2919**	**1313**	**0**

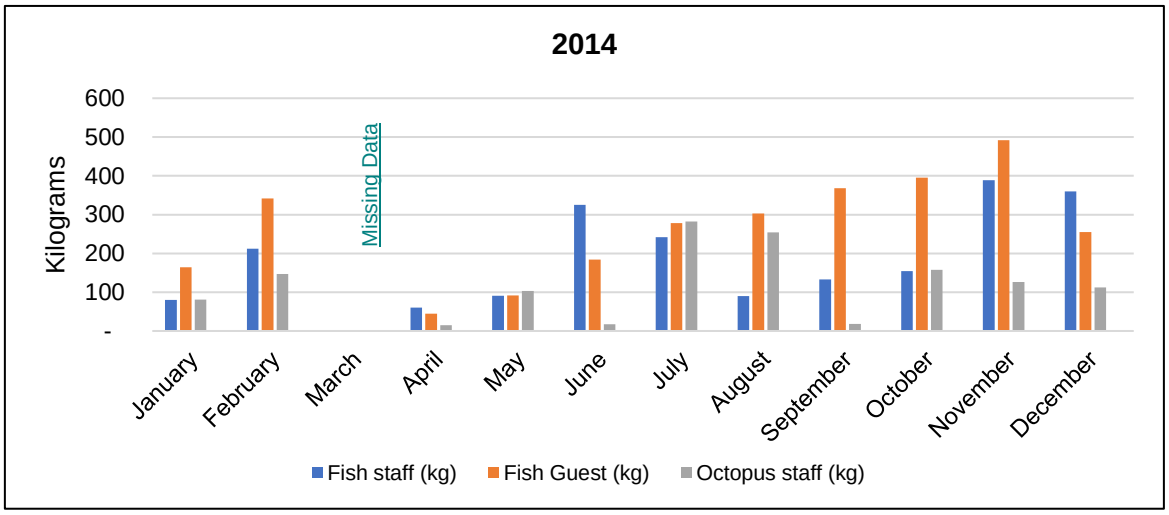


Figure 4.5 Monthly purchases of fish and octopus for guest and staff consumption for 2014

According to Figure 4.5, no octopus purchases were made for guest consumption for the entire year of 2014.

Figure 4.6 illustrates that overall for the year of 2014, an average of 45% of fish was purchased for guest consumption vs. 34% for staff consumption with an average of 20% octopus for staff consumption. Furthermore, no octopus purchases were made for guest consumption.

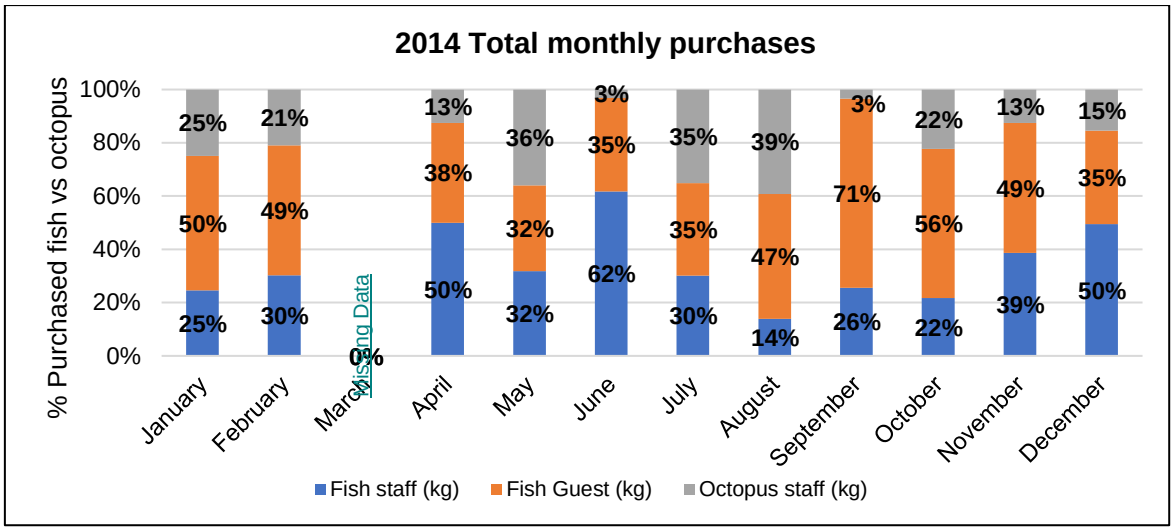


Figure 4.6 Percentage of fish and octopus purchased for guest and staff consumption for 2014

Figure 4.7 illustrates the monthly total weight of fish bought by the Lodge for both staff and guest consumption. Data is missing for the month of March, where no fish purchases were recorded by the Lodge. The total weight of fish bought for guest consumption is 2919kg and for staff 2776kg respectively. The average weight of fish bought per month, taking the average over an 11-month data period, is 243kg for guest fish purchase and 178kg for staff fish purchases.

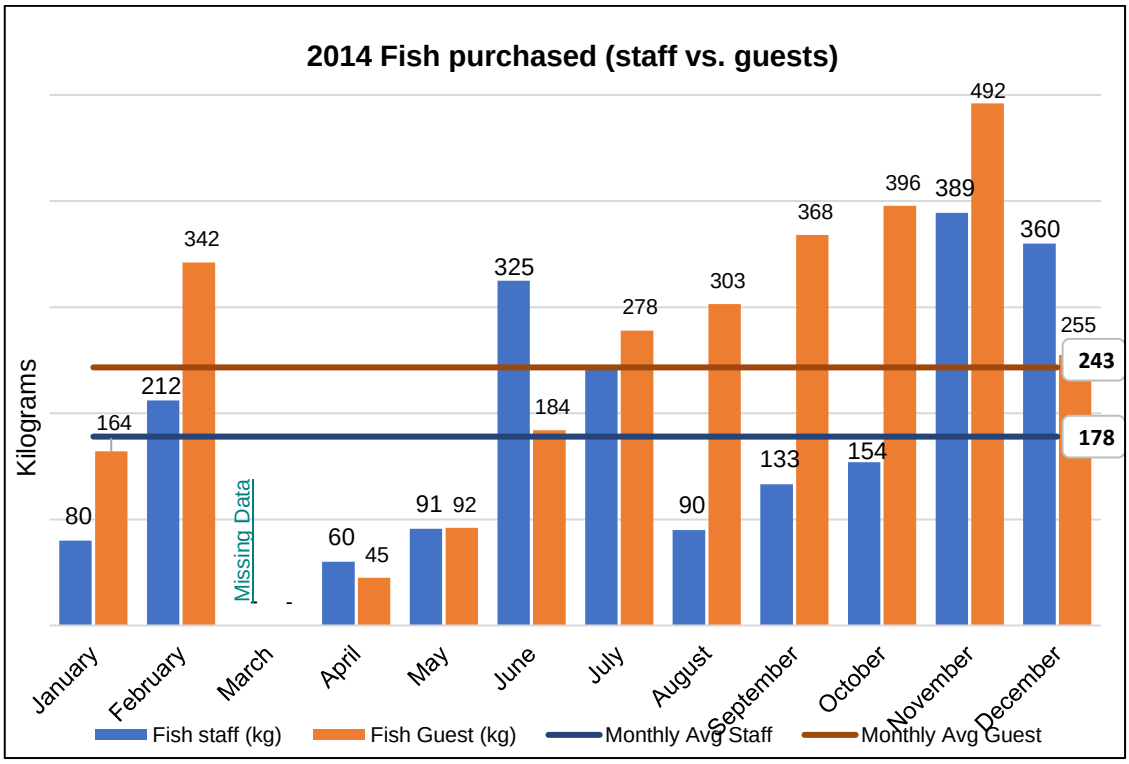


Figure 4.7 Monthly totals of fish purchased for staff and guests for 2014

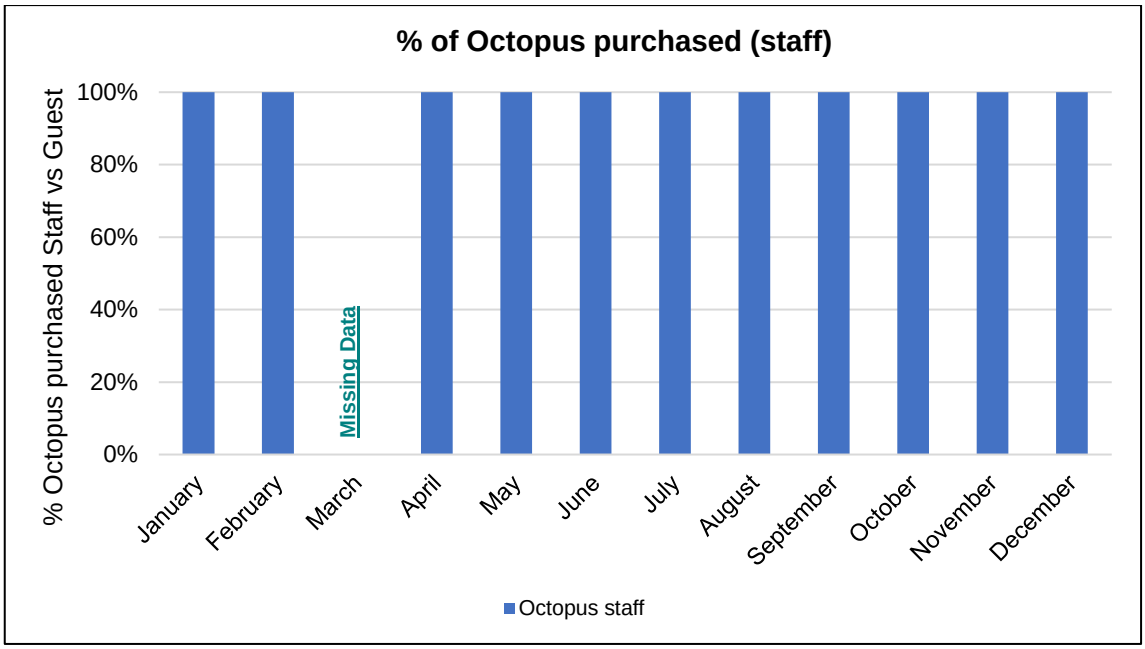


Figure 4.8 Percentage of octopus purchased for staff for 2014

By implication, according to Figure 4.8, no octopus purchases for guest consumption was made for the entire year of 2014, thus all purchases were for the staff.

Table 4.4 Total weight of fish and octopus purchased by Lodge for guest and staff consumption for 2015

Month	Fish staff (kg)	Fish guests (kg)	Octopus staff (kg)	Octopus guests (kg)
January	177	121	0	0
February	360	344	137	0
March	322	447	146	0
April	42	31	50	0
May	120	64	0	0
June	105	235	168	0
July	33	7	0	0
August	95	73	119	0
September	131	227	54	0
October	407	330	0	0
November	335	485	42	0
December	332	345	130	0
Total	**2459**	**2709**	**846**	**0**

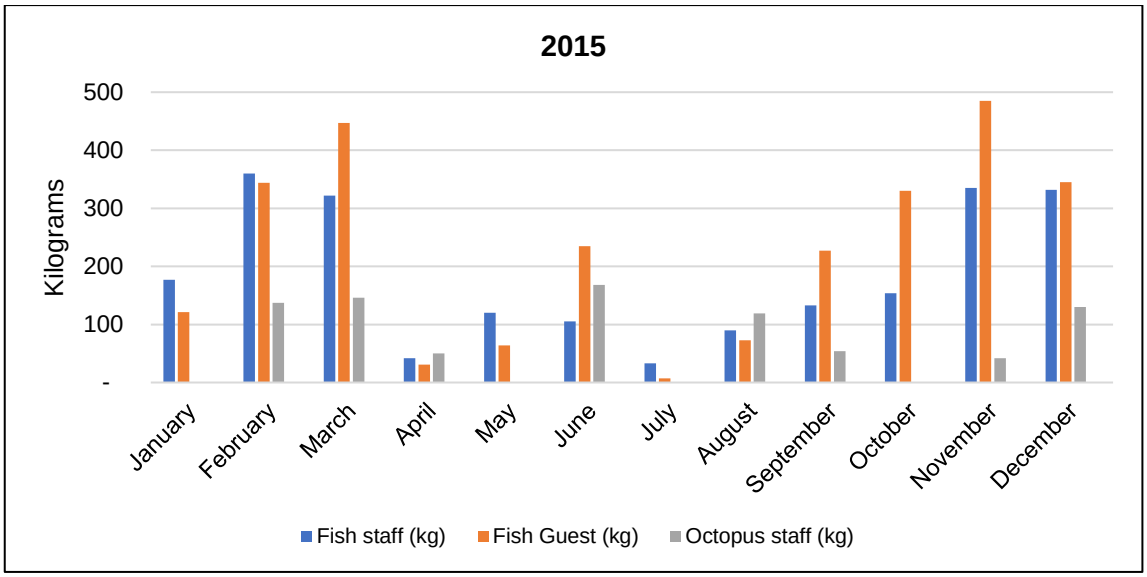


Figure 4.9 Monthly purchases of fish and octopus for guest and staff consumption for 2015

Table 4.4, shows the total weight of fish and octopus bought by the Lodge in 2015 for staff and guest consumption. According to Figure 4.9, the lowest months for purchases of both fish and octopus for staff and guest consumption, is from April until July. Figure 4.10 shows that of the total purchases of fish, the average was 39% for guest consumption and 45% for staff consumption. Regarding octopus, an average of 15% was for staff consumption and no purchases were made of octopus for guest consumption.

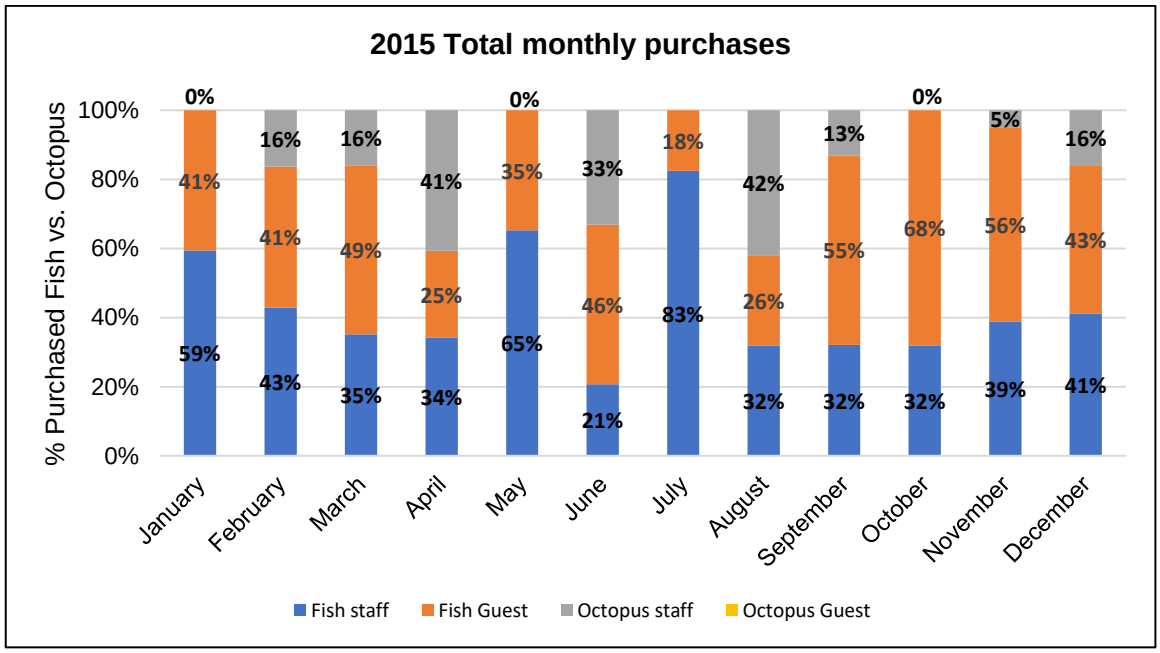


Figure 4.10 Percentage of fish and octopus purchased for guest and staff consumption for 2015

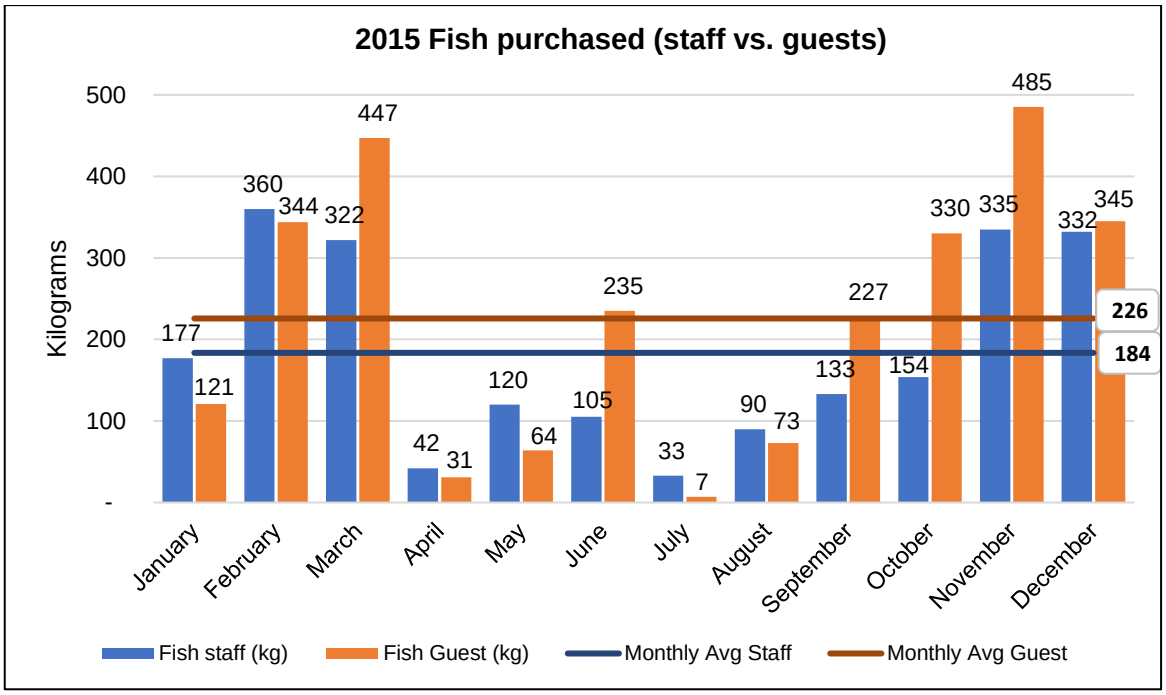


Figure 4.11 Monthly totals of fish purchased for staff and guests for 2015

Figure 4.11 demonstrates the monthly total weights of fish bought by the Lodge for both staff and guest consumption and the two horizontal lines represent the average weight of fish purchases per month in kg for staff and guests respectively. The total weight of fish bought for guest consumption is 2709kg and for staff 2458kg. The average weight of fish bought per month, taking the average over a 12-month data period, is 226kg for guest fish purchase and 184kg for staff fish purchase.

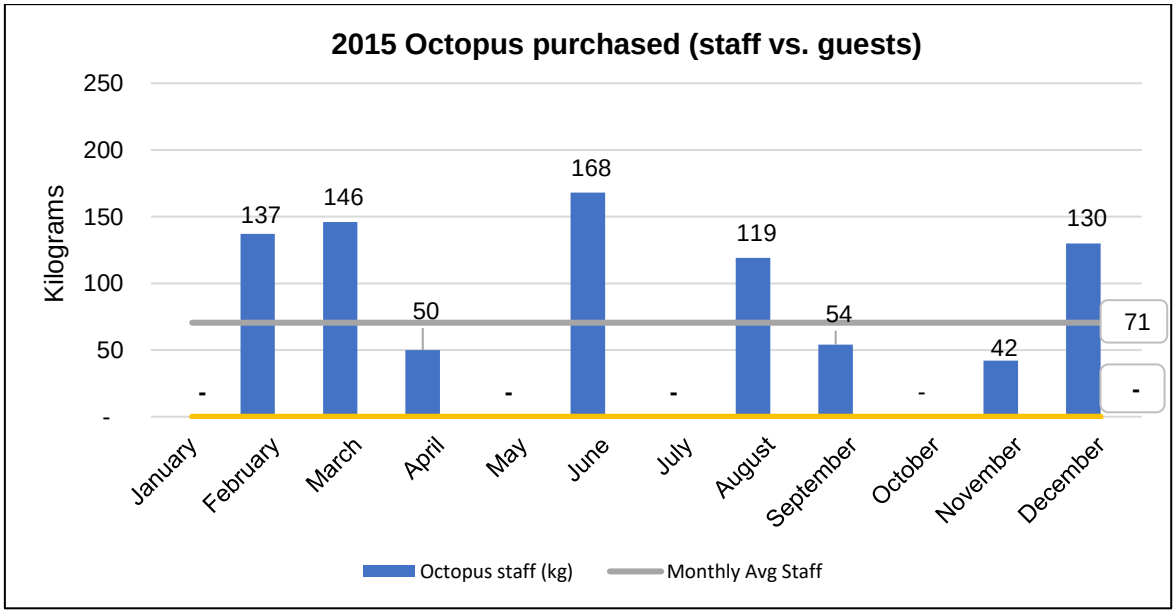


Figure 4.12 Amount of octopus purchased for both staff and guests for 2015

Table 4.5 Total weight of fish and octopus purchases by Lodge for guest and staff consumption for 2016

Month	Fish staff (kg)	Fish guests (kg)	Octopus staff (kg)	Octopus guests (kg)
January	387	296	5	0
February	388	369	59	0
March	320	327	179	0
April	99	58	15	0
May	194	231	43	0
June	0	0	0	0
July	289	414	213	0
August	184	549	175	0
September	202	411	129	0
October	304	398	125	0
November	284	384	149	15
December	400	531	5	0
Total	**3051**	**3968**	**1097**	**15**

No octopus purchases were made by the Lodge for the months of January, May, July and October (Figure 4.12). The average weight of octopus purchased for an 8-month period is 71kg per month. Table 4.5, shows the total weight of fish and octopus bought by the Lodge in 2016 for staff and guest consumption.

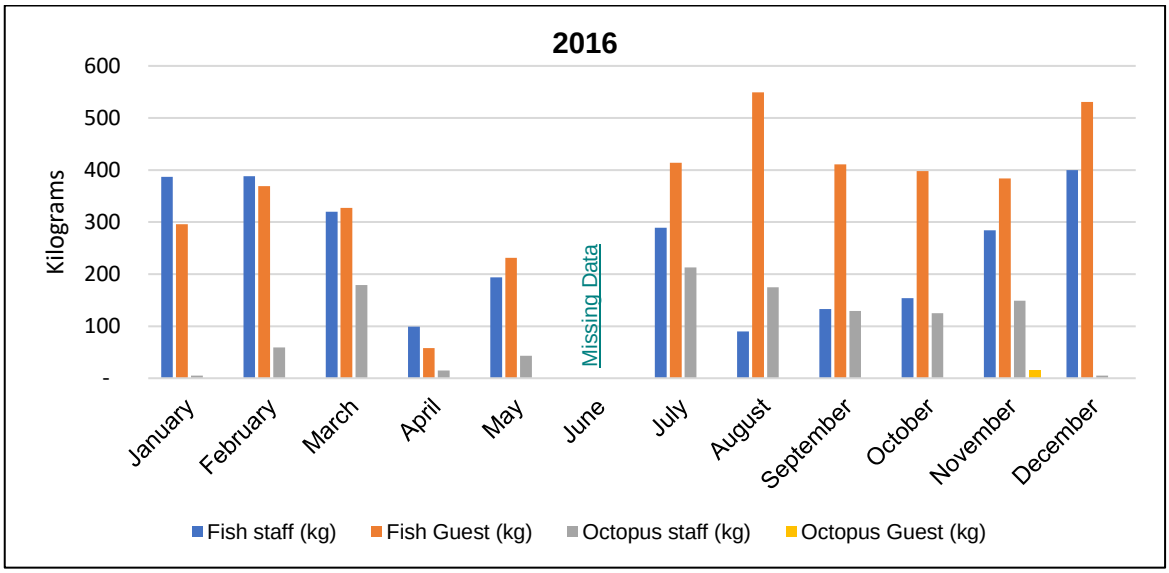


Figure 4.13 Monthly purchases of fish and octopus for guest and staff consumption for 2016

Figure 4.13 illustrates that octopus purchases were made for staff for every month of the year, except for January and December. Furthermore, the only month where

octopus purchases were made for guest consumption was November. Data for the month of June was not available.

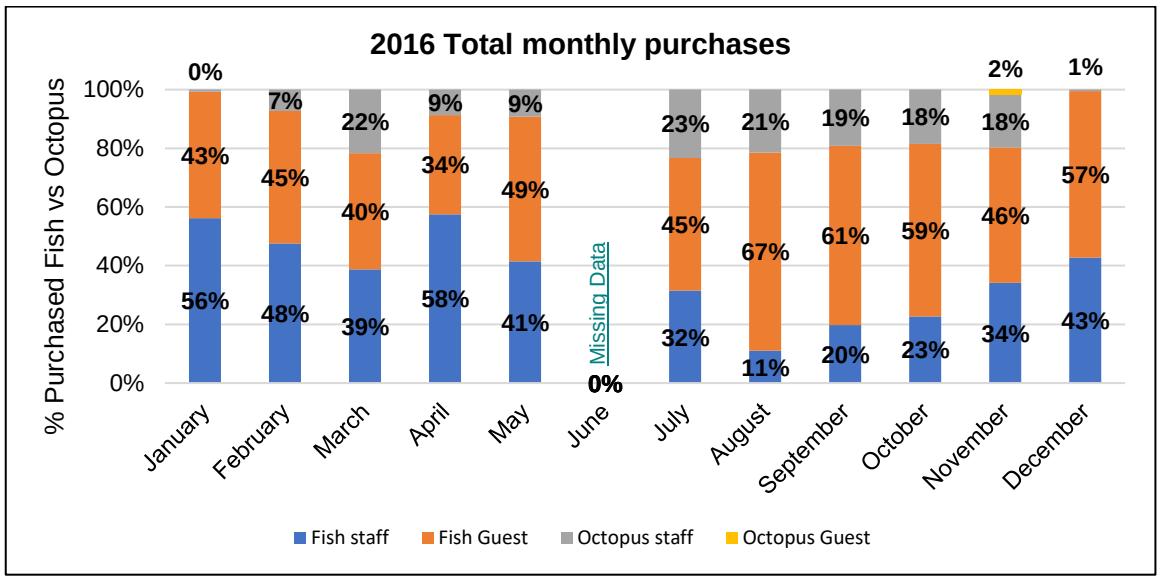


Figure 4.14 Percentage of fish and octopus purchased for guest and staff consumption for 2016

The graph in Figure 4.14 represents the total percentages of fish and octopus bought by the Lodge for staff and guest consumption. Of the total purchases of fish, an average of 49% was for guest consumption and 36% for staff consumption. For octopus, an average of 13% was for staff consumption and only in November, 0.18% purchase of octopus was made for guest consumption.

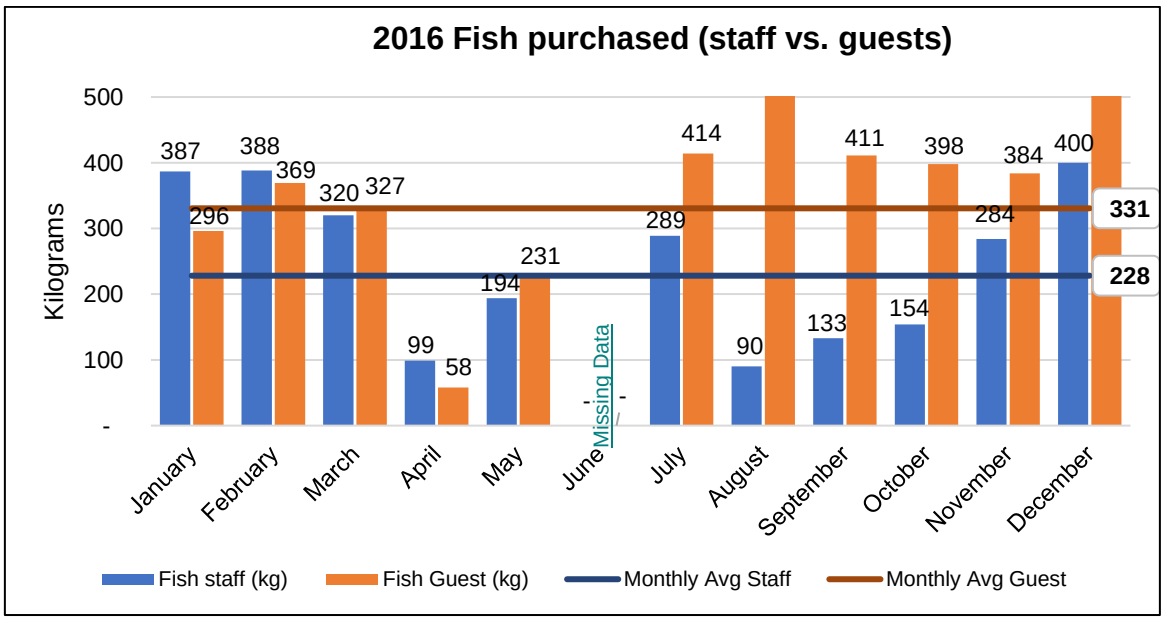


Figure 4.15 Monthly totals of fish purchased for staff and guests for 2016

Figure 4.15 illustrates the monthly total weights of fish bought by the lodge for both staff and guest consumption. The horizontal line represents the average weight of fish purchases per month in kg for guests and staff respectively.

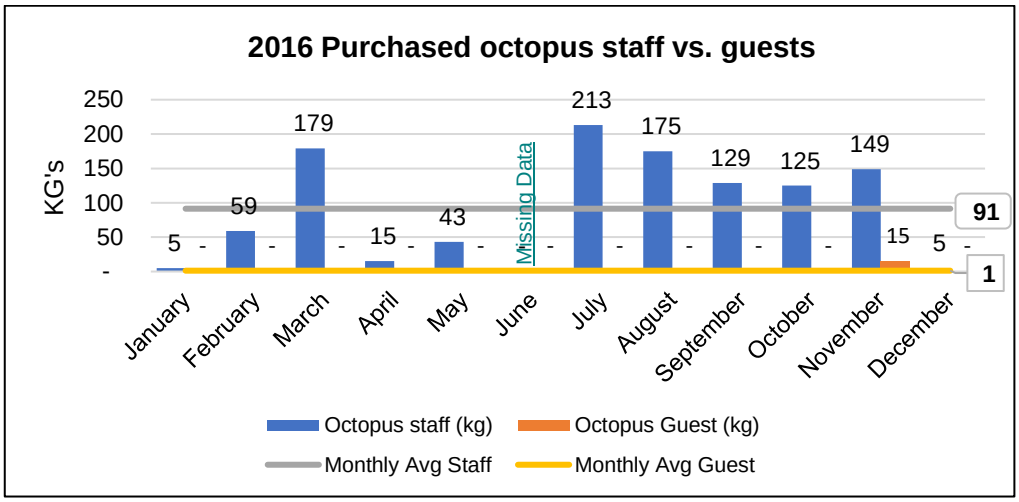


Figure 4.16 Percentage of octopus purchased for staff and guests for 2016

The total weight of fish bought for guest consumption is 3968kg and for staff 3051kg respectively. The average weight of fish bought per month, taking the average over an 11-month data period is 331kg for guest fish purchase and 228kg for staff fish purchases. No octopus purchases were made by the Lodge for the guests for the entire year, with the exception of November (Figure 4.16). Data is missing for June. Table 4.6 shows the total weight of fish and octopus bought by the Lodge in 2017 for staff and guest consumption.

Table 4.6 Total weight of fish and octopus purchases by Lodge for guest and staff consumption for 2017

Month	Fish staff (kg)	Fish guests (kg)	Octopus staff (kg)	Octopus guests (kg)
January	303	401	101	10
February	253	358	126	0
March	204	298	190	0
April	189	83	18	0
May	219	161	14	0
June	314	369	8	28
July	272	406	127	58
August	239	364	77	8
September	244	260	97	46
October	376	376	42	10
November	357	279	122	38
December	466	319	4	0
Total	**3436**	**3674**	**926**	**198**

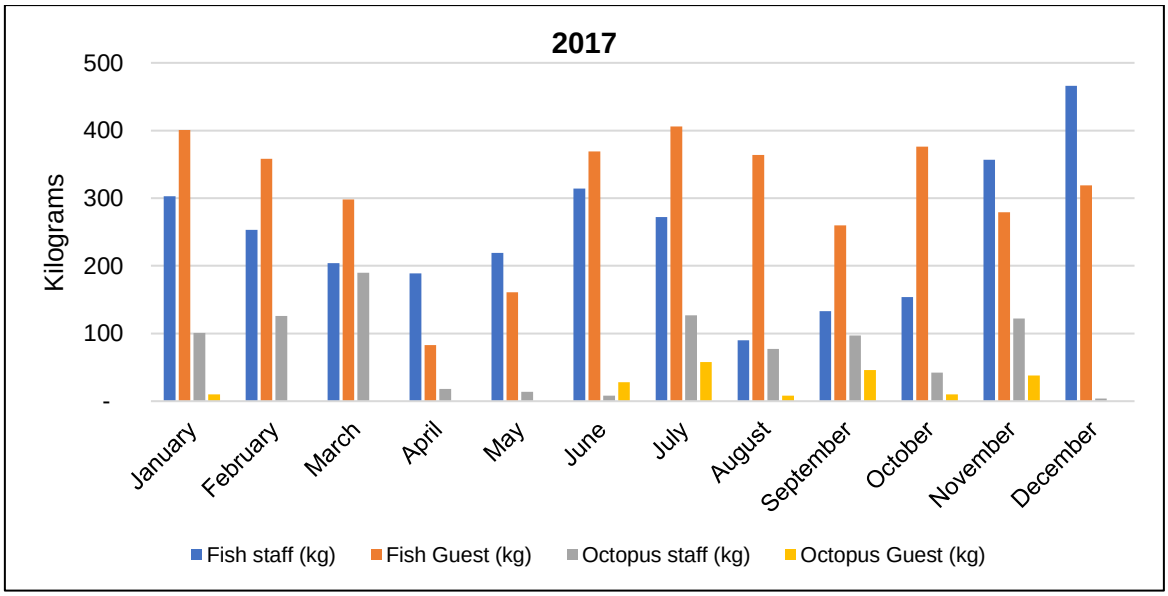


Figure 4.17 Total weight of fish and octopus purchases by Lodge for guest and staff consumption for 2017

Figure 4.17 shows that for the months, February to May, no octopus was purchased for guest consumption in 2017. Octopus was purchased for staff consumption for every month except December. This is the same as 2016.

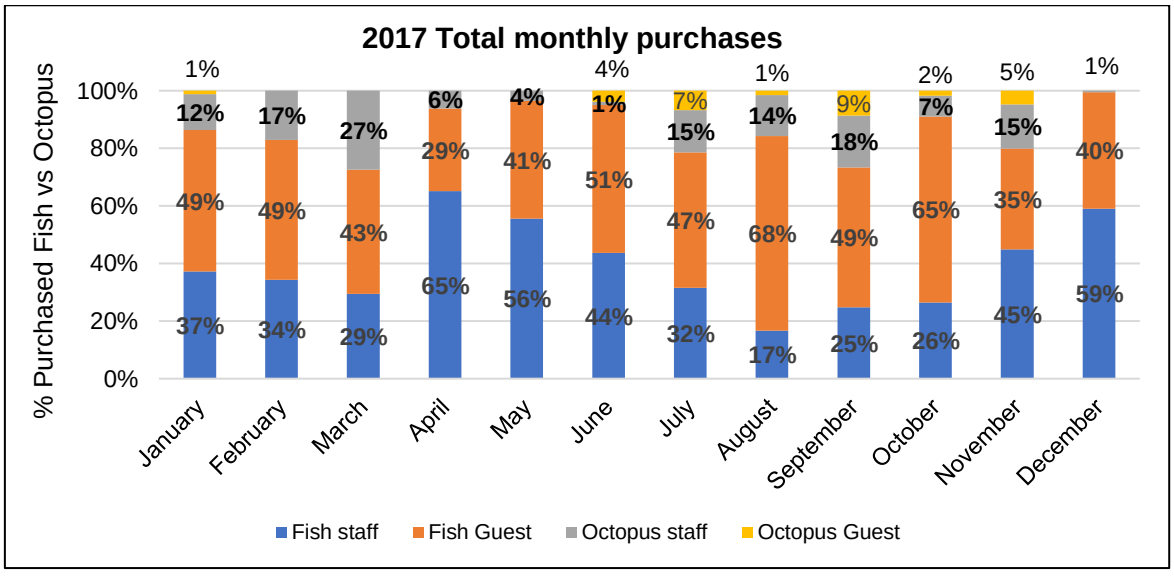


Figure 4.18 Percentage of fish and octopus purchased for guest and staff consumption for 2017

Figure 4.18 presents the total percentage of fish and octopus bought by the Lodge for staff and guest consumption. Of the total purchases of fish, there was an average of 47% for guest consumption and 39% for staff consumption. For the

purchase of octopus, an average of 13% was for staff consumption and 2% for guest consumption.

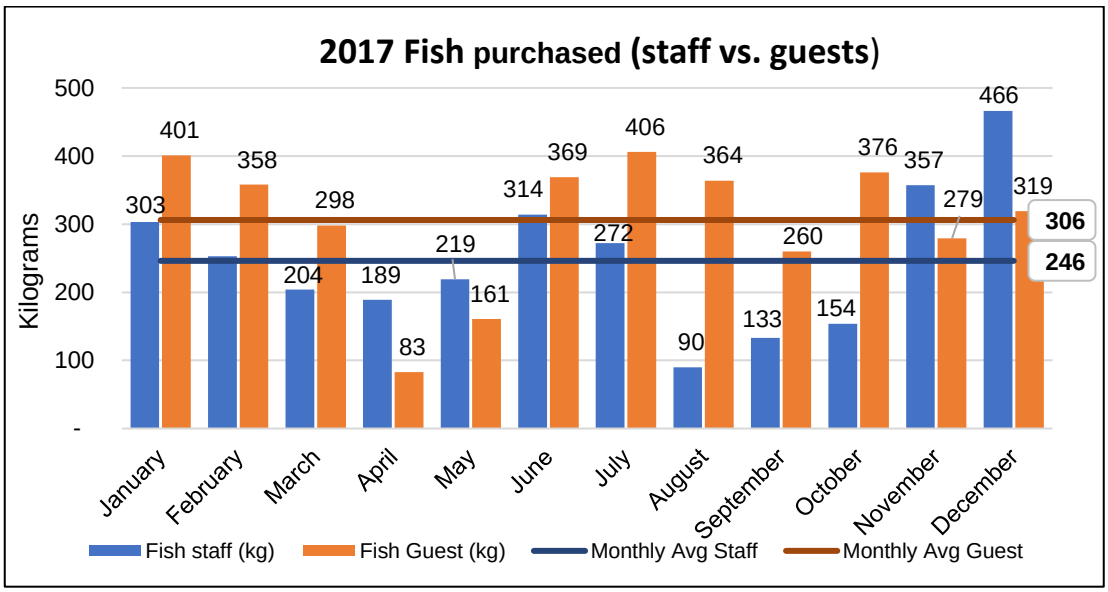


Figure 4.19 Monthly totals of fish purchased for staff and guests for 2017

Figure 4.19 shows the monthly total weight of fish bought by the Lodge for both staff and guest consumption. The line represents the average weight of fish purchases per month in kg for staff and guests respectively. The total weight of fish bought for guest consumption is 3674kg and for staff consumption 3436kg respectively. The average weight of fish bought per month, taking the average over a 12-month data period is 306kg for guest fish purchase and 246kg for staff fish purchases.

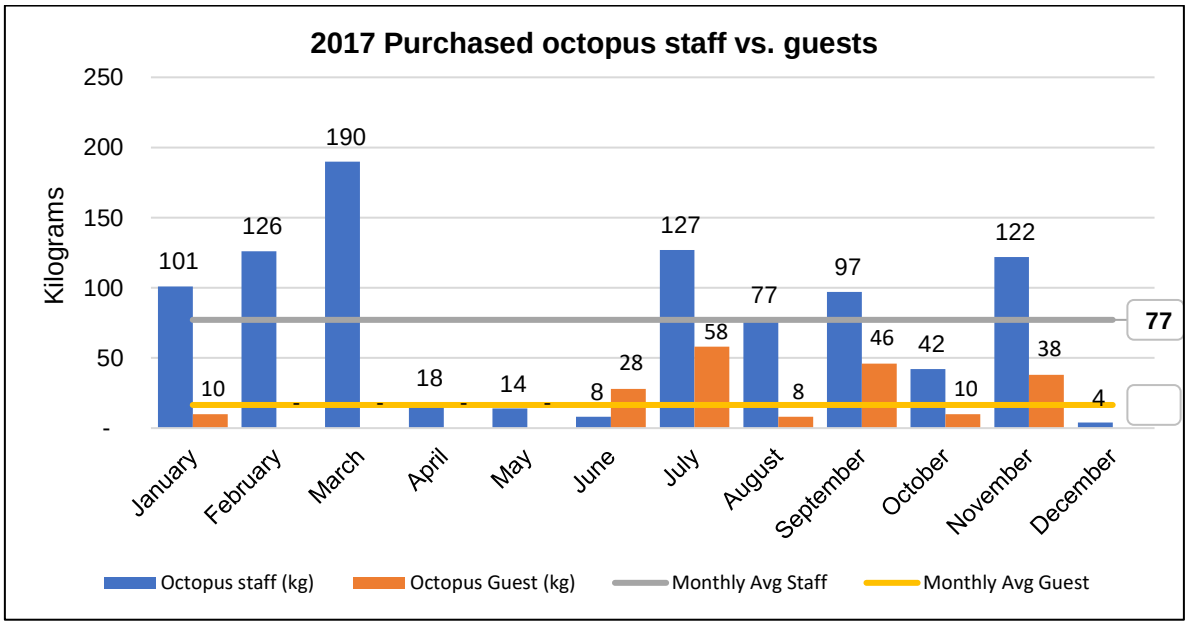


Figure 4.20 Percentage of octopus purchased for both staff and guests for 2017

Figure 4.20 indicates that octopus was purchased every month of the year, with the total weight being bought at 1124kg. The average weight of octopus purchased for guests is 17kg and 77kg for staff respectively.

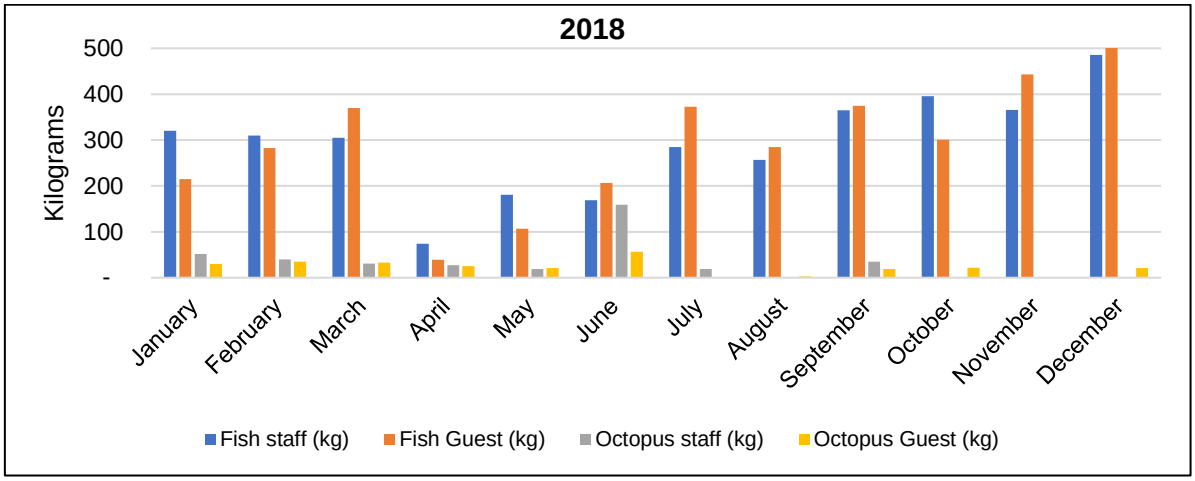


Figure 4.21 Total weight of fish and octopus purchases by Lodge for guest and staff consumption for 2018

Table 4.7 Total weight of fish and octopus purchases by Lodge for guest and staff consumption for 2018

Month	Fish staff (kg)	Fish guests (kg)	Octopus staff (kg)	Octopus guests (kg)
January	320	215	52	30
February	310	283	40	35
March	305	370	31	33
April	74	39	27	25
May	181	107	19	21
June	169	207	159	57
July	285	373	19	0
August	257	285	0	3
September	365	375	35	19
October	396	301	0	22
November	366	443	0	0
December	486	620	0	21
Total	**3514**	**3618**	**382**	**266**

Table 4.7 presents the total weight of fish and octopus purchases by the Lodge for guest and staff consumption for every month of 2018. Figure 4.21 illustrates these total purchases of fish and octopus for both staff and guests. The total weights of fish for staff being 3513.8kg and 3617kg for guests. The total octopus purchases for staff was 382kg and for guests 265.5kg.

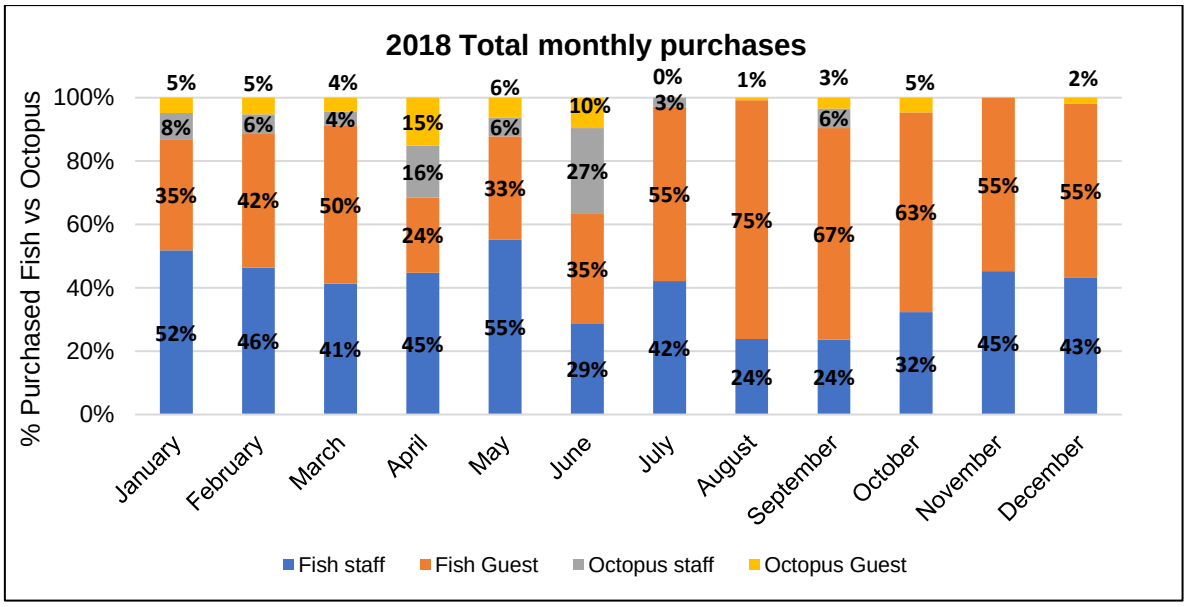


Figure 4.22 Percentage of fish and octopus purchased for staff and guest consumption for 2018

Figure 4.22 represents the total percentage of fish and octopus bought by the Lodge for staff and guest consumption. The graph illustrates that of the total purchases of fish with an average of 46% for guest consumption and 39% for staff consumption. For octopus, an average of 6% was for staff consumption and 4.5% purchase of octopus was made for guest consumption.

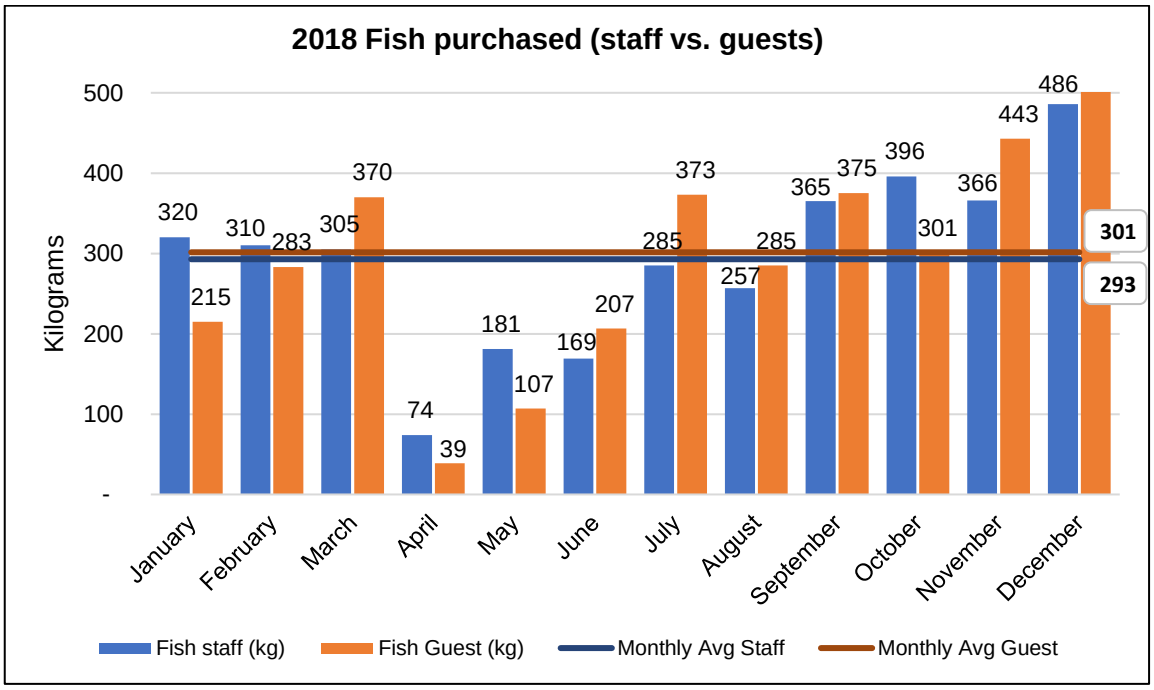


Figure 4.23 Monthly totals of fish purchased for staff and guests for 2018

Figure 4.23 shows the monthly total weights of fish bought by the Lodge for both staff and guest consumption in 2018. The lines represent the average weight of fish purchases per month in kg for staff and guests.

The total weights of fish bought for guest consumption is 3617.5kg and for staff 3513.8kg respectively. The average weight of fish bought per month, when taking the average over a 12-month data period, is 301kg for guest fish purchases and 293kg for staff fish purchases.

Figure 4.24 depicts that the highest amount of octopus was purchased for the month of June. There is no missing data, however, the graph shows that for the month of July no octopus was purchased for guests. August shows that no octopus was purchased for staff, as well as for October, November and December. This is very different from previous years where majority of the octopus purchased by the Lodge was for staff consumption.

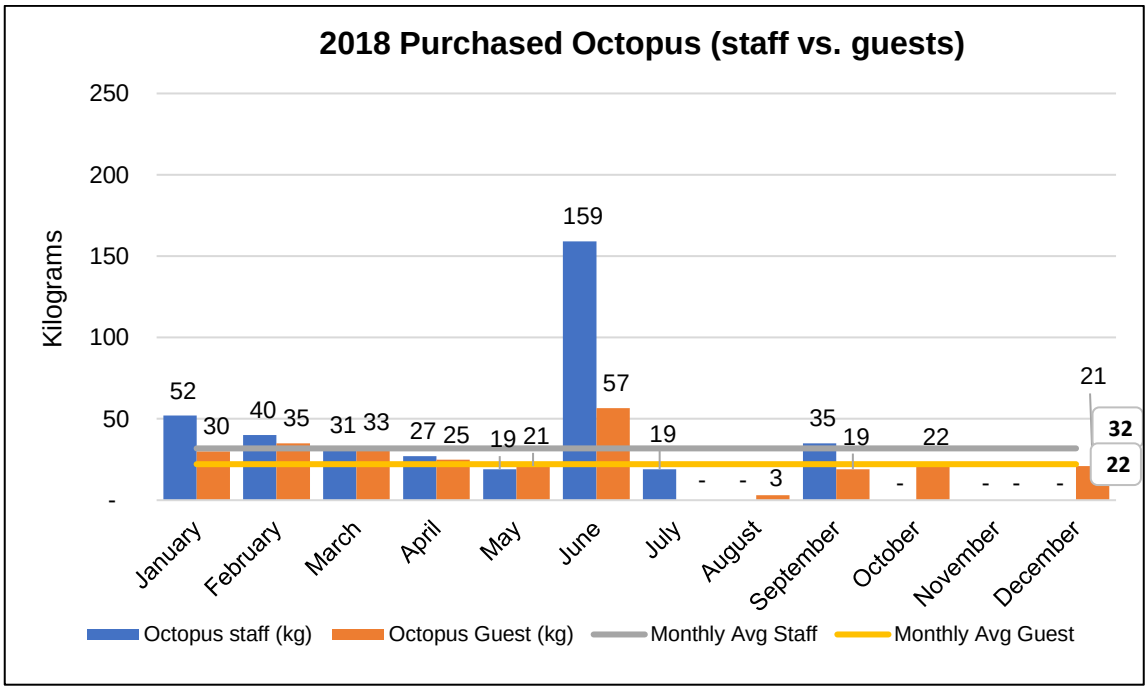


Figure 4.24 Percentage of octopus purchased for both staff and guests for 2018

In 2018, octopus was purchased for guest consumption for every month except July and November. The data was also analysed for a 6-year period, 2013 to 2018, to account for the total fish and octopus purchases. This was done in order to gain insight into the total amount of fish and octopus bought by the Lodge.

Table 4.8 Yearly fish and octopus purchases by Mnemba Island Lodge for a 6-year period

Year	Fish (kg)	Octopus (kg)
2013*	4286	740
2014**	5695	1313
2015	5377	846
2016**	7019	1112
2017	7110	1124
2018	7131	648
Total	**36617**	**5782**

* 10 months of data ** 11 months of data

On the examination of Figure 4.25 and Table 4.8, it is clear that the years 2013 through 2015 are below the average of 6103 kilograms of fish purchased by the Lodge per year. It must be noted that the data for 2013 only represents 10 months of data and 2014 and 2016 represents 11 months of data.

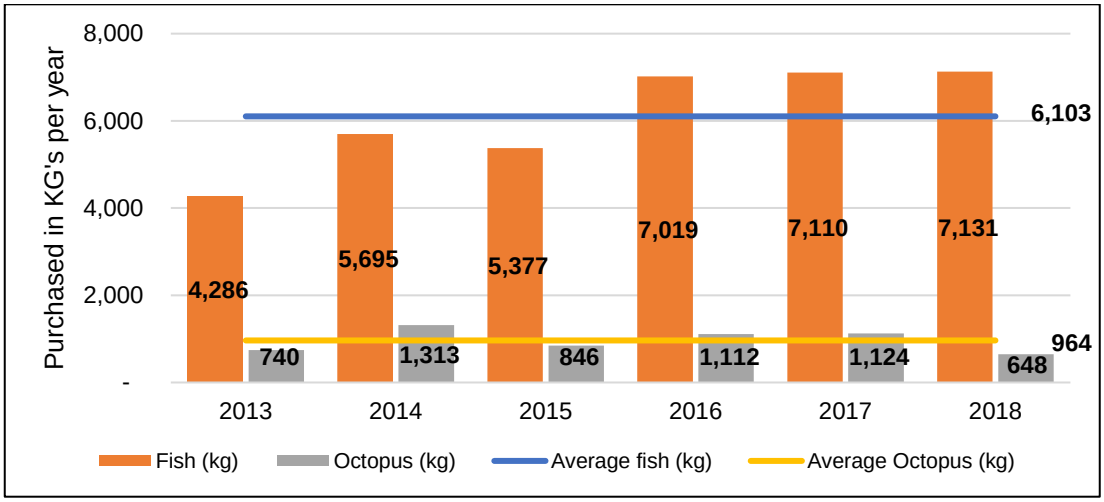


Figure 4.25 Yearly fish and octopus purchases by Mnemba Island Lodge for 2013-2018

This has also obscured the standard deviation, which is 1175.342 for fish and 258.158 for octopus and thus it has not been applied to this study. Furthermore, when assessing the data, it would be safe to assume that going forward from 2016 till present and future that accurate purchase reports must be kept by the Lodge in order to ascertain accurate trends in fish purchases. This will allow for more accurate future studies.

The graph also depicts that octopus purchases made by the Lodge are far less than that of fish bought, with the amount of fish being bought approximately six times

more than that of octopus. When looking at the data for the years 2016 to 2018 the fish purchased remained fairly stable with all above the average of 6.1 tons. It can be safe to assume that had accurate data been recorded for years 2013 to 2015, it would have shown a similar pattern. Hence it is concluded that the amount of fish being bought by the Lodge has remained consistent over a 6-year period.

When analysing and assessing the data of Figure 4.26 for the 6-year period, it can be seen that the largest purchases of fish in terms of weight are made from October till December each year and then carrying over into January. This is backed up by information gathered from the interviews, where it was ascertained that from the month preceding Christmas is when the larger fish such as Dorado, Sailfish and Tuna are caught by fishermen. This was observed during a visit to the Nungwi Fish Market in 2018, where large amounts of Sailfish was being auctioned off each day at the local fish market (Photograph 4.1).

Photograph 4.1 Nungwi fish monger auctioning off fish

The commencement dates of Ramadan[2] for each year, 2013-2018 to ascertain whether there are any trends associated with fish purchases by the Lodge and Ramadan. Ramadan began and ended on the following dates: 2013, 8 July - 7 August; 2014, 28 June – 28 July; 2015, 17 June – 16 July; 2016, 6 June - 5 July;

[2] Fasting during the month of Ramadan entails abstinence from eating and drinking between dawn and sunset and a major shift in meal times and patterns with associated changes in several hormones and circadian rhythms; whether there are accompanying changes in energy metabolism is unclear (Lessan *et al*. 2018).

2017, 26 May - 24 June; 2018, 16 May – 14 June. In the graph of Figure 4.26, the amount of fish bought by the Lodge with the commencement of Ramadan, shows a decrease and thus there is a significant correlation between fish purchases made by the Lodge and Ramadan.

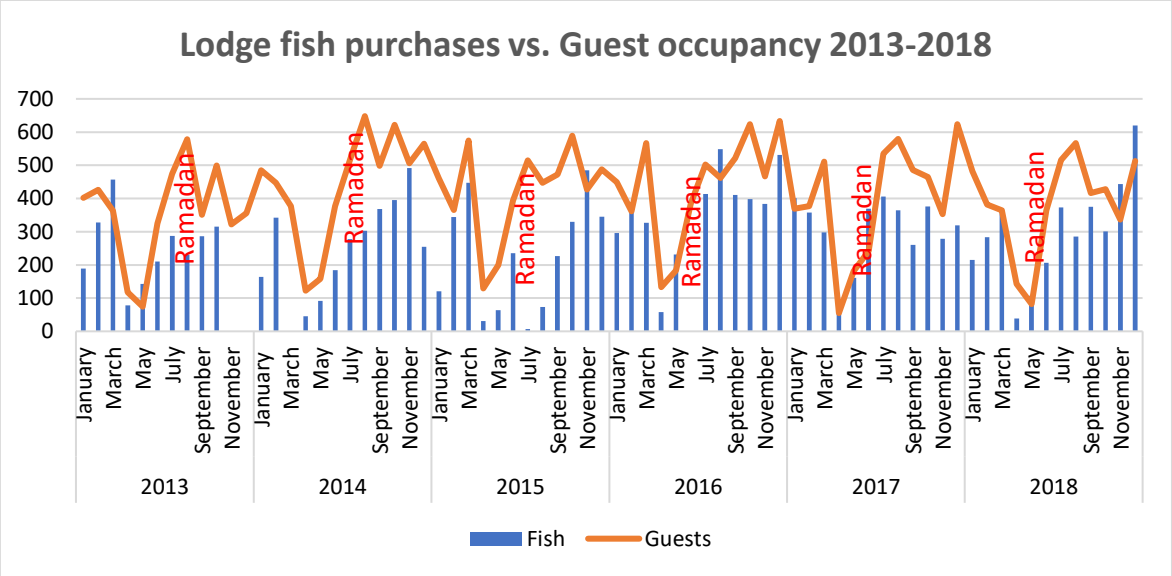


Figure 4.26 Total weight of fish bought for guests and staff per month for 2013-2018

Missing data: 2013=10 mo. of data (2 mo. missing); 2014=11 mo. of data (1 mo. missing); 2016=11 mo. of data

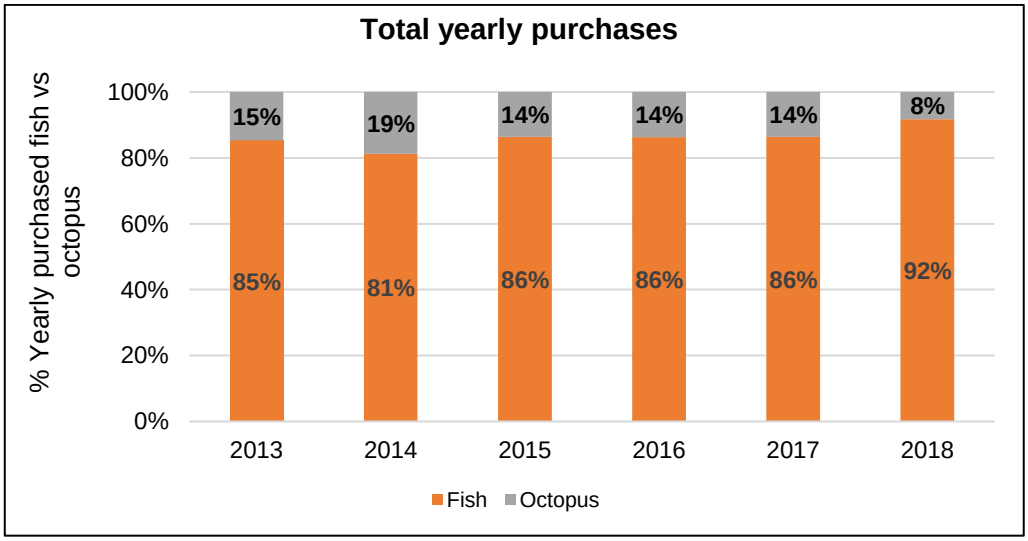


Figure 4.27 Total yearly percentage of fish and octopus purchases by Mnemba Island Lodge

The percentage of fish bought by the Lodge far exceeds that of octopus bought (Figure 4.27). Based on the monthly data graphs earlier in this chapter, it has also been shown that the staff are the main consumers of octopus. Could it then be

assumed that octopus is considered to be a local dish and not one which is preferred by high-end tourists?

This data is also consistent with the fishermen's interpretations of the fish stocks around Mnemba Island currently. However, the data does not provide the sizes of fish caught. It would be safe to assume that the sizes of fish have declined over the past few years, when the perceptions and statements from majority of the fishermen are taken into account. A fisherman interviewed on Matemwe Beach said:

> *There are too many fishermen catching too many fish, so now there is only small fish so we must to catch many small fish to eat because the big fish is not so much like before. Maybe the big fish will come back, but sometimes I think maybe they are gone forever.*

4.2.3 Results of interviews conducted on Mnemba Island

Several interviews were conducted with the Lodge staff whilst on Mnemba Island. This included those living in local villages who work on the Island, as well as professional staff, such as the dive instructor and the Lodge chef.

Interviews were conducted to determine which species of fish are most in demand by the Mnemba Island Lodge and by the local markets. One of the senior local Zanzibari employees residing on Mnemba Island indicated that when he arrived on the Island in 1996, there were far less people inhabiting the Island, which included Lodge staff and guests. Upon his arrival to Mnemba almost 24 years ago, there was an abundance of fish and the reefs were in pristine condition. Since the tourism market has increased, it has resulted in far more boats frequenting the Island for tourism purposes. This resulted in an increase in pressure on the reefs surrounding Mnemba.

This response aligns with Objective 1 of this study. The respondent indicated that the most targeted species include, tuna, grouper and kingfish. Furthermore, he indicated that the local markets do not have any preference for types or sizes of fish. The majority of fishermen fishing in the waters surrounding Mnemba come from the villages of Matemwe and Myoni. One interesting point that the respondent raised was that he believes the reefs along the east coast of Zanzibar, namely those occurring in Matemwe, have no more fish and the reefs are also dead due to people walking on the reefs.

> *The people they don't know how to catch fish in a good way, sometimes they want to catch too much fish. But before, when I was young, there was a lot of fish and a lot of octopus, because I am coming from Matemwe, where there are many octopus. But now there's not so much because the people they walk on the reef and the reef cannot survive like this. I think sometimes they want to catch too many fish because they want to sell for the hotel.* (Mnemba Island employee, 2015)

The respondent also indicated that a potential reason for the reduction in fish stocks was due to the increasing populations of the villages of Matemwe, Myoni and Nungwi. The majority of meals which are consumed is ocean-based nutrition.

This response aligns with Objectives 2 and 3 of this study, which aims to assess current fishing methods and practices used by fishermen. It also aims to assess if any destructive fishing methods are being used by fishermen. The respondent indicated that he was not aware of any destructive fishing methods being adopted and he was strict on insisting that dynamite fishing is illegal and none of the fishermen use this destructive method. Although illegal, some fishermen use small holed nets yet very few of them still use this type of netting as there catch rates are higher when targeting smaller species of fish. Jiddawi and Öhman (2002) described destructive fishing methods used in Zanzibar and that most of the destructive methods are prohibited by law, but continue to be used due to lack of surveillance, enforcement, and public awareness. Since a large number of the fishes are targeted, habitat degradation (Öhman & Rajasuriya, 1998; Öhman *et al*., 1998;) can have secondary effects on the standing stock of fish decreasing fish numbers (Öhman *et al*., 1997; Rajasuriya *et al*., 1998).

In addition, two types of mosquito nets are used (Jiddawi, 2000; Steinhoff, 2000). The first type is called *utazi wa mbavu* which is applied during the low tides of each spring tide. The second mosquito net is called *utazi wa juu* that is applied during neap tides at low tides. The fishing takes place close to shore. Between 20 and 30 women, usually fish together with a daily catch rate of 2-17kg per woman. The mosquito net fishery is a multi-species fishery with a majority (61%) of the specimen being below half the maximum size. The most common species from this fishery are *Plotosus lineatus*, *Atherioll africanus* and *Gerres oyena* usually comprising about 70% of the catch. The most common species caught by women are epipelagic shrimps, locally known as *uduvi* (Semesi *et al*., 1998).

In order to align with Objective 4 of this study that aims to provide recommendations for the improvement on sustainable fishing practices, a respondent stated that fishermen are not allowed to catch on House reef, thus MIMCA patrols the area. To demarcate the area of no fishing/buffer area of 200m, a buoy is placed in the water. The respondent stated that the majority of fishermen adhere to the restriction, however, sometimes older generation fishermen enter the area and fish. In these instances, the MIMCA rangers escort the fishermen out of the area and advise/educate them on the exclusionary zone. He attributed this to stubbornness of older fishermen as they believe they have a right to fish in the area, as they have been doing it for generations, prior to the implementation of MIMCA. An interview was conducted with the &Beyond dive instructor located on Mnemba Island. He said the following with regard to fishing practices around Mnemba Island:

> *I wouldn't say that in two years that I would be able to observe a distinct rise in fishermen out there, but I would assume from an historical perspective there would always be a lot. I mean this is their primary source of sustenance and food source, and as the population of the villages grow, well there's more fishing boats to feed more mouths. We also see that with the encroachment of these villages into these coastal towns, some of the fishermen are trading their ngalawas and traditional fishing boats for fiberglass boats and moving to tourism for an avenue for generating income. You'll be surprised what they are able to catch with those small vessels. They do a lot of fishing out at Malinga Kuwa on the eastern wall, over the eastern side.* (&Beyond dive instructor)

This statement backs up the observation as well as the data gathered through informal discussions with local fishermen, who claim that there are far more fishermen and fishing vessels in the area. Many of the younger fishermen are opting to diversify their income by trying to establish themselves as tour guides. As a result of this, many of the fishing vessels serve dual purposes, both as fishing vessels and as tourist boats. In terms of health and safety, as well as compliance with legislation governing tourism in Zanzibar, it is unknown whether many of these fishermen possess the necessary permits to operate tourism related activities. Taking this into consideration, it can be assumed that many of the local fishermen opt for the more financially viable option when the need arises.

Some conclusions were made to align with Objective 1 of the study, which aimed to investigate whether there is a rising trend for specific types of fish due to the

increase in the tourist market. Based on the interviews, the fishermen specifically target larger pelagic fish to sell to the Mnemba Island Lodge and other tourist hotels. However, the fishermen do not specifically go on fishing trips to supply fish to the Lodge. They go on fishing trips and fish for any types of fish regardless of species and then sell, as previously mentioned, the larger pelagic fish to the tourist hotels and the smaller fish and reef fish to the local market located in their respective villages. Mnemba Island Lodge was used as an indicator of fish sales over time, as the Lodge was willing to provide the data to the researcher for assessment of fish and octopus purchase data.

From the interviews and informal discussions, it was determined that no destructive fishing methods were observed to have been used by any of the fishermen interviewed. However, if destructive or illegal fishing methods are used, this information would most certainly not be voluntarily shared with any researcher. In terms of destruction of the reefs surrounding Mnemba, one of the main and greatest impacting factors to habitat destruction were the tourism activities. Increased tourism, boat traffic and tourism traffic on the reefs surrounding Mnemba pose serious environmental threats to the habitats and has the potential to be the major contributing factor to habitat destruction, if not managed effectively.

4.2.4 Results of interviews conducted in Matemwe

A total of 21 interviews were held with fishermen residing in the village. This analysis highlights common trends, similarities and differences in the opinions of the fishermen with regard to current fishing practices and fish stocks, which occur within the fishing grounds surrounding Mnemba. It aligns with the objective of the study relating to the assessment of the current fishing practices and methods of fishing used by fishermen. The most common fishing gear utilised by the fishermen that were interviewed are nets, hand lines, dema traps (Photograph 4.2) and spear guns. These traditional methods of fishing are deemed non-destructive and have been used for generations without any changes.

The majority of the fishermen in Matemwe fish along the reefs off the coast of Mnemba, namely Kichouani and Coral Garden with a greater majority of the fishermen targeting bigger fish, such as Grouper and Barracuda. This is associated

with Objective 2 of the study, which aimed to assess current fishing practices and methods of fishing currently being used by fishermen.

Photograph 4.2 Dema traps on Matemwe beach

Although the fishermen target specific species of fish, all fish which are caught are kept and sold at the local market, regardless of size. A common trend amongst many of the fishermen is the perception that fish stocks and sizes of fish being caught have reduced in the last 10 years. They attributed this to there being too many fishermen in the area.

Photograph 4.3 Eagle ray and species of grouper caught off coast of Matemwe

Photograph 4.4 Array of reef fish caught off the coast of Matemwe

Size 11 sandal placed next to fish for size reference

Photograph 4.5 Sailfish caught off coast of Nungwi in December 2018

Unlike Nungwi, Matemwe village is not as popular as a tourist destination and thus the number of hotels and lodges situated within the village is not high. When all the fish caught, if not sold to Mnemba Island Lodge, it is sold at the local fish market located along the beachfront and not directly close to the hotels in the village.

Due to the locality of Matemwe village in relation to Mnemba Island, 9 out of the 21 interviewees indicated that they sell some of their catches directly to the Lodge located on Mnemba. They indicated that the Lodge only buys big fish and prefers certain species, such as Tuna, Dorado, Barracuda, Jackfish, Kingfish and Octopus. Octopus is a commonly caught species in Matemwe. This can be attributed to the marine environment located off the beachfront where the octopus reside: *It's less, it's different. In previous years, I was able to get octopus of 20 maybe 30 kilos. But now I am lucky if I get even 3 kilos* (a fisherman).

Photograph 4.6 Garfish and a Parrotfish sold at Nungwi fish market

Photograph 4.7 Dorado caught off coast of Nungwi

Women also partake in fishing activities in Matemwe, in the form of octopus fishing. Octopus is a critical source of food (Guard, 2009; Rocliffe & Harris, 2015) and also a growing cash generating income source in east Africa and the entire Western Indian Ocean region (Wamukota *et al*., 2014). Despite this, octopus fishing is rarely accounted for in management and governmental statistics (Rocliffe & Harris, 2015). Traditionally, octopus fishing has been dominated by women and children and is one of the few income sources for this social group.

MIMCA was originally created for two reasons, namely to protect the marine resources of Mnemba atoll and to provide an end to the contention between local communities and tourism operators using the atoll (Revolutionary Government of Zanzibar, 2007). The aims of MIMCA are to protect the reefs surrounding Mnemba from fishing activities. Through the establishment of MIMCA, an exclusive "no take" zone of 200m surrounds the entire island.

All the interviewees were aware of the MIMCA conservation area and adhere to the 200m buffer zone. However, despite being aware of the restriction and the adherence thereto, the fishermen indicated that they previously used these areas as fishing grounds and as a result of the restriction, they now must travel further to catch fish. They are all fully aware of the importance of the area for conservation and that it encourages tourism in the area.

During the period of data collection in September 2017, spring tide was in occurrence and thus many of the fishermen were using this time to make repairs to their vessels and equipment. The reason for this is that Matemwe lies inshore of a fringing reef, which restricts access during spring low tides for larger vessels to access the deeper waters beyond the reef. On the morning of September 21st, there were 61 fishing vessels docked on Matemwe beach.

A local on the beach explained this during an informal discussion.

> *During the springtide not a lot of fishermen go fishing. Today is the springtide, so only maybe the spear fishermen is to go fishing, but not fishing with the nets and hand lines. They fix the boats in the spring tide. They go fishing when it's the neap tide. So sometimes when they catch the fish, they take it to the Stone Town market to sell the fish. But, when there is no fish then we have to go to the store to buy the beans and eat with the dry fish. I*

am no longer a fisherman, I am a student now. I went to study computers because I want to be an agent for tourists to make money for my family.

The common species being caught around Matemwe during the period of data collection consisted of a mixture of Snappers, Emperors and Groupers, all species that are commonly caught using hand lines. Added to this, a few species of Parrot and Surgeon fish was caught by using dema traps.

In Matemwe, most of the fishermen do not have any other forms of income or skills besides fishing. Only one of the interviewees indicated that he has an alternate form of income as a causal labourer during times when he is not fishing. This further highlights the dependence on the sea for livelihoods and income. Furthermore, some time was spent with the local "beach boys" who offer tourism activities to tourists walking along the beachfront. One of the beach boys imparted the following:

We are beach boys not fishermen. We don't want to fish because it is too much work for not too much money. We rather want to sit on the beach and speak to tourists because they buy things from us. It is better to sit on the beach than to find a job in the hotel, because we can't get good job because we don't want to go to school.

Photograph 4.8 Parrot fish caught by a local fisherman

The results of the interviews show that Matemwe and its geographical setting allows for different species of fish being more abundant than that of Nungwi, which will be discussed in the next section. The fringing reef that encompasses Matemwe allows for a very sheltered area in which octopus populations thrive, thus a vast majority of women are involved in the primary stage of fishing in this village. Furthermore, due to the fringing reef, larger vessels, such as dhows are restricted from accessing fishing grounds during very low tides, such as spring tide and have to wait until full high tide before departing for fishing trips. Hence, the fishermen of Matemwe have to adjust their fishing trips according to the tides and this has a direct impact on the times at which the Matemwe fish market operates.

Relating to Objective 1 of the study, the species of fish being sold at the Matemwe market is an indication that the fishermen do not target specific species of fish, but rather catch all species and then sell it at the fish market. During data collection, there was an abundance of reef fish, Snake Fish and Eels being sold at the market. During the entire data collection period, no large predatory species, such as Yellowfin Tuna, Dorado or Kingfish was sold at Matemwe fish market. In terms of Objective 2 of the study, it was noted when observing docked fishing vessels that nets, hand lines and dema traps are the most common gear being used by the fishermen of this village, with no destructive methods having been noticed.

The fishermen indicated that they do not adopt any destructive fishing techniques as this would jeopardise the reefs and would thus lead to the destruction of habitats, which the respondents were not in favour of. In conclusion, due to the nature of Matemwe and its geographical setting, it is not the most popular area for tourists and thus the demand for fish from tourist hotels is not as large as the demand would be in a more popular tourist area, such as Nungwi.

4.2.5 Results of interviews conducted in Nungwi

Several interviews, discussions and informal talks were held with fishermen residing in Nungwi village. This analysis aims to highlight common trends, similarities and differences in the opinion of the fishermen with regard to current fishing practices and fish stocks, which occur within the fishing grounds surrounding Nungwi and Mnemba.

The most common fishing techniques used by the fishermen of Nungwi are the same as the majority of the villages in Zanzibar, such as hand lines, nets, dema traps and spear guns. A larger majority of Nungwi fishermen use motorised fiberglass boats and are thus able to access the reefs and other fishing grounds quite easily. Dhows and Ngalawas (outrigger canoes) are also very popular vessels being used. Different vessels are used when targeting different species of fish. Ngalawas mainly target nearshore species, such as Snappers, Emperors, Rabbitfish and Groupers, whereas the larger dhows and fiberglass boats target larger fish, such as Marlin, Kingfish, Sailfish and Yellowfin Tuna (Jiddawi & Öhman, 2002).

The fish being sold at the Nungwi fish market consisted of large predatory fish, such as Sailfish, Yellowfin Tuna and Dorado. However, there was a vast array of reef fish also on sale at the market. No Snake Fish or Eels and very few octopus were on sale at the market. The most common fishing grounds being used by the Nungwi fishermen are Kichouani, Chakatuni and Coral Garden (Figure 4.30), with many of the older generation fishermen indicating that they used to use the Mnemba Island atoll as a fishing ground in previous years.

> *I have a lot of experience, 30 years. Fishing is a game, sometimes you get and sometimes you don't. But now the wind has changed, Kaskazi from North to South, the fish is coming. I like the hotels, of course before we have some trouble, because when fishermen catch fish we must go to Stone Town to sell our fish. The road was very bad, the bus leaves at 8 and get to Stone Town at 5 or 6, but now we can sell to Nungwi market and the hotel buys direct. The hotels, they buy too much too much fish, and you know how many restaurants are there? Every day they need fish. You know before the people are catching fish like now, but they had no-one to sell it to, but now we have a good market so we just want to catch more and more.*
> (Fisherman in Nungwi, 2018)

It is quite evident that the perception amongst the fishermen is that the more fish they catch the more they can sell, which in turn results in generating a higher income. In terms of alignment with Objective 1 of the study, the Nungwi fishermen stated that they have a preference for catching larger species, such as Yellowfin Tuna, Kingfish, Dorado, etc. as these fetch a higher price premium and are in higher demand from the large amount of tourist hotels located in Nungwi. However, the fishermen also indicated that whilst fishing for larger

species of fish, they fish for smaller reef species at the same time. This is to satisfy the demand from the local market, which does not have a preference for species. Despite this demand for fish from the tourist hotels, none of the fishermen indicated that they use destructive fishing gear of methods.

The results of globalisation, tourism and tourist influence on the local Zanzibari people has resulted in the notion that the standard and lifestyle of the traditional Zanzibari way of life is somewhat sub-standard to the worldly accepted view. This has resulted in the creation of a society that realistically cannot attain western standards of living, as the resources, education levels, political instability, and geographical context of Zanzibar cannot support this way of living any longer. However, the traditional subsistence way of life is more than sufficient to provide the majority of Zanzibaris a healthy and fulfilling life. An informal discussion with an old fisherman revealed that:

> *In Zanzibar, before many tourist came here, we were very satisfied with being fishermen and to farm. We had too much fish to eat and not many hotels. We like the tourist because they come to the hotels so we can have jobs, but we were very happy also before they came. But now, the children they are seeing many nice things the tourist have, many nice clothes and phones, but before we didn't have these things and we were very happy. But now we want new things like the tourists but we don't have money to buy these things because to be fisherman we don't make a lot of money, only enough to feed our family but not to buy nice things.*

This notion is further supported by the findings of Juma (2012) where it was stated that many natural and human related economic activities cause changes in the physical environment and pressure on the land. This is because of the limited options of types and scale of the economy they can adopt.

To control the situation, good governance should call for improvements that touch virtually all aspects of the public sectors. This is due to institutions that set the rules of the game for economic and political interaction, to decision-making structures that determine priorities among public problems and allocate resources to respond to them, as well as to organisations that manage administrative systems and deliver goods and services to citizens.

4.2.6 Are destructive fishing methods being adopted in the waters surrounding Mnemba, Matemwe and Nungwi?

In terms of Objective 3 of the study which aimed at investigating the implications of destructive fishing methods, of all the fishermen interviewed, none of them indicated that they adopted any destructive fishing [3]methods and try to, as far as possible, adhere to the rules enforced by a somewhat disinterested and lacking government.

> *Any government that didn't maintain peace isn't a good government. Zanzibar has a good government because they maintain peace. They don't stop us from fishing and allowing us to be fishermen. They have good policies and good plans, but they don't have money.* (Nungwi fisherman)

The most common fishing gear utilised by the fishermen interviewed are nets, hand lines, dema traps and spear guns. These traditional methods of fishing are not considered to be destructive and have been used for generations without any changes in the types of fishing gear being used. From the informal talks with local fishermen and through participant observation, the fisherman target larger species of fish, such as Dorado, Yellowfin Tuna and Kingfish. However, it was also noted that whichever species are caught, by any of the fishing methods, are kept and sold at the local market. This is both true for Nungwi and Matemwe markets.

The local market does not have a preference for any specific species of fish and all fish caught are sold and consumed by the local villagers. The fishermen do not sell their catches directly to the lodges and hotels, except for Mnemba Island Lodge. The catches are sold at the local fish market and then bought by fish mongers, who then sell them to the hotels and lodges. Taking cognisance of this, the fishermen believe that due to the presence and increasing influx of tourism in the area, the prices of fish are being driven up by fishmongers and more sort after species, such as Yellowfin Tuna are unattainable for the local villagers due to the higher prices. The fish is sold at the fish market via an auction system, which often drives up the prices and this is having a detrimental impact on the local villagers, who often cannot

[3] One of the most destructive fishing techniques is dynamiting. This has been practiced in Tanzania for over 4 decades. This activity has contributed to the degradation of habitats and fisheries productivity. Dynamite fishing was reported in the waters surrounding Mafia Island for many years. Other destructive techniques include beach seine fishing and the use of drag nets (Jiddawi & Öhman, 2002).

afford to buy fish. As a result of this, the villagers buy any other fish which is being sold at the fish market, this includes reef fish and rays.

Dorado, Yellowfin Tuna and Sailfish were caught on a daily basis during the data collection period (December 2018). The fishermen indicated that December is the time of year in which these species are abundant. Furthermore, many of the fishermen stated that mid to end of December, the North easterly wind known as Kaskazi blows and drives the fish toward Pemba Island.

Photograph 4.9 Ngalawa on Matemwe beach

Photograph 4.10 Traditional dhow being repaired in Nungwi

Unlike Matemwe, fishermen in Nungwi do not use many dug out boats (Ngalawa) and majority of the fishermen use fiberglass boats and dhows. Ngalawas are dugout canoes with outriggers and a sail and can carry up to 6 people at a time. Ngalwas are mainly used for nearshore fishing trips (Photograph 4.8). Dhows are much larger than Ngalawas and can carry up to several people at a time (Photograph 4.9). Most of the fishermen fish off the reefs surrounding Tumbatu Island and even banks located in the Pemba Channel north of Nungwi. One of the fishermen indicated that due to the declining fish stocks, they travel as far as Somalian waters to fish. Although all fish caught are kept, the fishermen specifically target the following species: Octopus, Kingfish, Grouper, Yellowfin Tuna, Snapper, Barracuda and Dorado.

Based on the interviews conducted, 40% of the fishermen indicated that amongst the other reefs located away from Mnemba, they also use the fishing grounds around Mnemba Island. All fishermen interviewed were aware of the MIMCA conservation area and strictly adhere to its restrictions. Sixty percent of the Nungwi fishermen indicated that they believe that the overall amount of fish being caught has been reduced in the last 10 years and certain species are becoming more difficult to catch. Examples of these species are Grouper and Red Snapper.

> *No, no, no, it's very little. In previous years, you could take maybe one week without fish, but now, sometimes up to a month without fish. I think we say that the issue that we have many, many fishermen and the methods that we have. Our methods and tools don't allow us to go fish where there are many fish.* (A fisherman)

Photograph 4.11 Local Nungwi fishermen relax after a hard morning's fishing under one of many banders located next to fish market

One of the fishermen indicated that he believes that the reason for the reduction in catches is due to overfishing and there being too many fishermen in the area. Furthermore, he stated that in most cases, fishermen have no other options for income generation, as their skill sets are low and thus fishing is the only form of work they can undertake.

> *Many young fishermen, when they fail at school they have no other way to make money. Fishing is our heritage and tradition. Many of them if they fail they become fishermen, they don't have any skills. Because the people, they don't have any work to do. Today is science and technology world, and we don't have any knowledge how to use machines. Our fathers depend on fishing, and their income is low and people can't afford to get good education.* (Fisherman)

Figure 4.28 Map depicting the reefs of Zanzibar

This is supported by the study conducted by Sangree *et al.* (2015, p. 172) when stating:

> *Subsistence fisheries around the world are at a pivotal point. Population growth and demand for seafood are increasing production pressure and catch sizes are deteriorating as a result. In the absence of new management strategies, many fisheries will collapse and the communities, which rely on them, will suffer substantial hardship*.

This could lead to the conclusion that one of the reasons for the high number of fishermen could be attributed to a lack of education and skills being afforded the local people to broaden their possible job prospects. Of the 10 interviews conducted, three of the interviewees stated that they are no longer consistent daily fishermen, but rather they undertake charted fishing trips for tourists. The common reefs (Figure 4.29) that are used by the fishermen interviewed include Coral Garden, Kichouani, Small Wall and Big Wall. The figure provides the localities of each reef in relation to the study areas.

4.3 DISCUSSION

On looking at the data provided by the lodge, as well as through the interviews and informal discussions conducted, it is evident that there are differing views by many of the locals as to whether fish stocks are declining or remaining stable. The only statistical data gathered was from the lodge on Mnemba Island, where records of fish and octopus bought was captured. No real statistical data was recorded by the local fishermen on the numbers or weights of fish being caught and thus this highlights the need to adopt an accurate catch monitoring system. This will aid in the conservation and sustainable management of the resources.

In a visit to the Stone Town fish market revealed that the number of fish and the sizes of fish being caught in other areas, other than around Mnemba Island, Matemwe village and Moyoni villages are relatively stable and there does not seem to be any noticeable reduction in these yields. This study focused particularly on Mnemba Island and the surrounding villages and not on Zanzibar as a whole.

The visit to Matemwe village indicated that many of the local fishermen used spear guns as a means of fishing. However, the *Fisheries Act No. 8 of 1988* states that

no destructive fishing methods may be conducted around Mnemba Island. The areas of Matemwe village fall into this community, and according to the Act, community is described as the following: '*Community' mean residents within the Shehias of Kijini, Matemwe, Nungwi and Pwani Mchangan.*

According to the Act, destructive fishing is described as:

> *'Destructive fishing' means all fishing activities, practices, gears and methods prohibited by the Fisheries Act, 1988 including use of drag nets, use of nets having mesh size of less the 1½ inches, use the spear gun, carrying out fishing that involve the use of poles to break the corals, and practise any other fishing that destruct marine ecosystems."* (Zanzibar Government, 2002)

In this, one can see that despite there being an Act in place, there is a possible lack in knowledge or even awareness of the Act by the local communities. Despite this, the MIMCA zone excludes fishermen from all forms of fishing around Mnemba Island's exclusionary zone, which extends approximately 200m from the low tide mark and this is evident when examining the coral reef systems within the MIMCA zone. House reef showed higher rates of biodiversity, abundance, and indicator species and due to the MIMCA rule stating that the House reef is a "no take zone" for reduced fishing improves the conditions for fish communities to thrive (Johansen & Kennedy, 2014).

Whilst snorkelling on the reefs surrounding Mnemba that the reefs appeared to have been impacted upon negatively, possibly by increased tourism related impacts. During initial data collection in August 2015, the reefs were healthy with an abundance of fish species present. However, during the 2017 data collection phase, the researcher noted that the very same coral reefs from two years prior had been degraded to the point where there was no colour left in large areas of coral reefs. Furthermore, the number and differing species of fish had also decreased. The study conducted by Burgoyne *et al*. (2015) confirmed that parts if the Mnemba atoll was being damaged by poor utilisation practices, both by fishing and tourism activities. Stakeholders who frequently use the Mnemba reefs have witnessed that tourism-related activities have damaged coral on the atoll. Anchor-related coral damage at a popular snorkelling reef was observed. These results align with those

of others who found that tourism-related activities can damage the environment (Nangle & Sheng, 2010; Rotarou, 2013).

The study conducted by Johansen and Kennedy (2014) highlighted that despite the presence of MIMCA Rangers there is a lack of enforcement.

> *They are three men in a small boat with a 15 horse power engine, who have been told not to retaliate or argue should someone not follow the rules, and are expected to ask a trawler of 30 angry fishermen who have been fishing these waters for hundreds of years, and who have a motor with four times the power, and who threaten the rangers with violence, to kindly fish somewhere else."* (Johansen & Kennedy, 2014, p. 39)

Photograph 4.12 Kingfish bought by Mnemba Island Lodge weighing 8kg

From the ranger's perspective, telling these men to take their gear elsewhere, could be understandably quite intimidating, particularly when the only weapon the rangers have at their disposal is a telephone call to MIMCA management who is an hour and a half away and may or may not send reinforcements. It is also important to note the suggestion that the rangers have difficulty enforcing rules upon their own people, as the rangers come from the same geographical areas, villages and communities the fisherman and boat operators come from.

It seems as though the rangers are faced with the difficult task of confronting a host of infraction with a limited number of means with which to correct them on a daily basis. This has given them a bad reputation, but as representatives of MIMCA, it has given the area itself a bad name. To improve this situation, it seems prudent

that rangers be given further education and equipment that will enable them to carry out their duties in a more effective manner. The question must be asked. Can the fishermen, who are constantly breaking MIMCA rules, be blamed for continuing to fish as they have done for hundreds of years? If a fisherman does not see the benefit on his end for adhering to the MIMCA regulations, and he has a net, a boat, and children with empty bellies at home, is he expected to stand by and let his children starve or will he go out and fish to put food on the table? There is no long-term vision when there are hungry children at home. The fishermen, as well as local communities, report that the reason they continue to fish illegally is because they do not see any benefit for following the rules of MIMCA.

Conclusions of the interviews conducted in the three study areas, Mnemba Island, Matemwe and Nungwi all have differing geographical settings that makes each of them unique. However, fishermen from the villages of Matemwe and Nungwi all use common fishing grounds surrounding Mnemba Island. The village of Myoni is also in very close proximity to Matemwe and interviews conducted in Matemwe included fishermen from Myoni as well. The perceptions of the fishermen mostly align, with a majority of the fishermen claiming that their catch rates, sizes of fish and frequency of catching certain species has decreased over the years. They have attributed this to increasing populations, increased demand for fish by the tourist as well as the local market and the high and ever-increasing number of fishermen. Many of them believe that the reason for the high numbers of fishermen is the lack of education, training and skills offered to them and thus they have no other forms of generating income.

A similarity between Matemwe and Nungwi fish markets is that the local people do not prefer certain species of fish and purchase and consume all species regardless of size. This is supported by an example response in an interview with a local Matemwe resident and also an employee of the Mnemba Island Lodge.

> *I was a fisherman two years ago for full time. When I go to fish in the deep, on top in the deep, so sometimes I want to catch Kingfish, sometimes Barracuda. Sometimes I sell here at &Beyond, but when I come here I must only sell the big fish. &Beyond only want to buy the big fish. I am fishing from the Ngalawa. I am only going to fishing when I am off, when I am not working at &Beyond. Now in 2015, we did not have a lot of fish, we only have few, because we have many many fishermen to find there catching*

the fish. Only many small fish now this year, before there was many big fish, sometimes equal big fish and sometimes small fish."

No destructive fishing gear was being used by any of the fishermen and none of the fishermen indicated that they adopt any destructive fishing practices. Traditional artisanal fishing gear is used and despite the increased demand for fish, the fishermen do not employ any destructive fishing gear. Due to the differing geographical nature of Matemwe and Nungwi, certain species occur in Matemwe which do not occur in Nungwi or Mnemba, that being octopus, which thrive in the fringing reef surround Matemwe village. Furthermore, during the time of data collection, the fish market in Nungwi had an abundance of large species of fish, which included large daily catches of Sailfish and Dorado, whereas the fish market in Matemwe, had an abundance of small fish, including reef fish, Eels and Snake Fish. This also plays a role in the involvement of women in fisheries. In Matemwe, women play an active role in octopus fishing, whereas in Nungwi, women are more active in the processing of fish as the biophysical setting of Nungwi is not one where octopus is known to occur.

The fishermen selected for this study mostly reside in the villages of Matemwe and Nungwi and use the waters surrounding Mnemba for fishing activities. Mnemba Island is not permanently inhabited by any fishermen and thus, when this study refers to Mnemba fishermen, it refers to Mnemba Island Lodge staff who are fishermen during times when they are not residing on the island as &Beyond employees.

The local fish markets of Matemwe and Nungwi do not dictate which species of fish fishermen specifically target, however, the demand from hotels and tourism establishments have preferences for certain fish species and thus this may influence fish species targeted by fishermen. Passive artisanal fishing methods are used by all the respondents and no destructive fishing gear seemed to have been adopted. The respondents of the interviews are all aware of the MIMCA zonation and as far as possible abide by it.

In terms of future management, it is suggested that capacity building and incentives be afforded to local villages to educate them on the effects of destructive fishing, overfish and unsustainable resource use that it may pose on them. This must be

done in order to ensure effective environmental management for the three study areas and for Zanzibar as a whole.

4.4 ANALYSIS

While transitioning to sustainable fisheries is crucial, there are at least three root causes that explain why it is so challenging. First, since achieving sustainable fishing typically requires a reduction in fishing effort and changes in fishing practices for some period of time, there are usually short-term financial losses throughout the value chain. Those players who, often for subsistence reasons resulting from a lack of alternative opportunities, place a higher value chain on short-term benefits and may be less concerned about driving a fishery to collapse than about losing short-term harvests. Secondly, even when a fishery reaches a sustainable state, its economic and other benefits may not be evenly distributed among different players. Fisheries restoration benefits for long-term solutions may have the reverse effect on other stakeholders. Thirdly, data gathering, and adequate fisheries management is difficult to put into action due to various limiting factors, which includes lack of basic education and poverty. Ineffective management of global fisheries is likely to result in the depletion of a shared resource and into a state of unrecoverable ecological and economic losses (Bonini *et al.*, 2011).

When analysing the data, the interviews conducted together with the photographic evidence, the following analysis and assumptions can be concluded. It can be safe to assume that there is a majority of the older generation fishermen that are of the perception that the fish stocks are declining and that many of the more common species which were caught in the past, are very few in the current time. Furthermore, the sizes of the fish being caught is a lot smaller than what it was in previous years. They have attributed this to the fact that there are far too many fishermen all hunting for the same species of fish in order to supply the increased demand for fish by creating tourism activities and increasing the population of the respective villages. This is backed up by the following said by a local fisherman on Nungwi beach.

> *There are some fish that are very rare, they were abundant before but now they are very rare. Yes, it is true, we have to go further now to catch fish. Some days we get big fish, like Tuna, Dorado but some days we get very*

small fish. If you compare from previous years, we used to get a lot of red snapper but now not so much like before. I think even 20 years is too many years, maybe 10 years more like it before there is no more fish for us to catch.

Despite the perceived reductions in both the sizes of fish and total catch amounts, no destructive fishing methods have been adopted by any of the fishermen who were interviewed. Another consensus amongst the fishermen is that the influx of tourism in these areas, as well as the construction of large tourist hotels and resorts has resulted in increased pressure, both on the fishermen and on the local fish stocks. One of the fishermen interviewed stated that the presence of the hotels has driven up the demand for fish, they have also contributed to employment for the local people, whether it be directly or indirectly. *"Hotels are a good thing, as even if I am not employed by the hotel, some of my family members are. The hotels sponsor the infrastructure for the local people."* (Nungwi fisherman, 2018)

Photograph 4.13 Fish on sale infront of a beachfront hotel on Nungwi coast

The photograph above depicts fish on sale along a beachfront hotel restaurant, which allows patrons the opportunity to choose which species of fish they would like to eat. Each evening fresh fish was on display for purchase.

4.4.1 Analysis of Lodge data

The data provided by the Lodge indicates that the amount of fish being bought by the lodge is fairly consistent with a total of approximately 30 tons of fish being bought

over a 4-year period. However, the data only goes back 6 years from 2018, which does not provide comprehensive data for comparison over a 10-20-year period which could provide trends of fish being bought. The evidence has also shown that at the local fish market, almost all species of fish being caught are sold off for auction, regardless of size or conservation status. It must also be noted that, majority of the fishermen are not aware of conservation status of the fish nor of any prohibitions.

4.4.2 Occupancy data vs. fish purchase data

This section aims to analyse the relationship between the Mnemba Island Lodge occupancy data versus the guest fish purchase data for each year (Table 4.9). It aims at analysis whether there is an increase in fish purchases for months when guest occupancy was high.

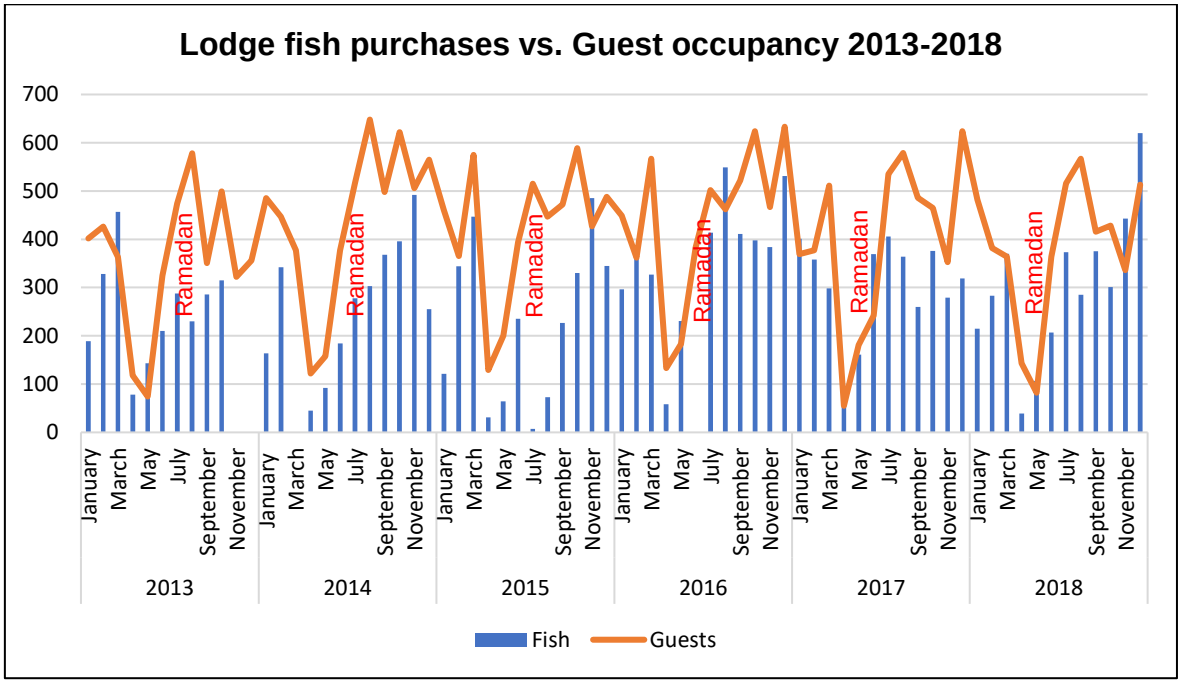
Table 4.9 Total guest fish purchases vs. lodge occupancy for 2013-2018

Year	Month	Fish (kg)	Guests		Year	Month	Fish (kg)	Guests
2013	January	189	402		**2016**	January	296	449
	February	328	426			February	369	362
	March	457	363			March	327	567
	April	78	118			April	58	133
	May	143	74			May	231	183
	June	210	325			June	0	384
	July	288	474			July	414	502
	August	230	578			August	549	462
	September	286	351			September	411	522
	October	315	499			October	398	624
	November	0	322			November	384	467
	December	0	356			December	531	633
2014	January	164	485		**2017**	January	401	369
	February	342	447			February	358	377
	March	0	377			March	298	511
	April	45	122			April	83	55
	May	92	158			May	161	181
	June	184	377			June	369	242
	July	278	518			July	406	535
	August	303	648			August	364	579
	September	368	498			September	260	486
	October	396	622			October	376	465
	November	492	506			November	279	353
	December	255	565			December	319	624
2015	January	121	461		**2018**	January	215	482
	February	344	365			February	283	382
	March	447	575			March	370	364

continued

Table 4.9 Total guest fish purchases vs. lodge occupancy for 2013-2018 *(continued)*

Year	Month	Fish (kg)	Guests		Year	Month	Fish (kg)	Guests
2015	April	31	129		**2018**	April	39	143
(*cont.*)	May	64	200		(*cont.*)	May	107	82
	June	235	394			June	207	364
	July	7	515			July	373	516
	August	73	447			August	285	567
	September	227	472			September	375	416
	October	330	589			October	301	428
	November	485	427			November	443	336
	December	345	488			December	620	513



Missing data: 2013, 10 mo. data (2 mo. missing); 2014, 11 mo. data (1 mo. missing); 2016, 11 mo. data (1 mo. missing) mo.=month

Figure 4.29 Lodge fish purchases in kg per month vs. guest occupancy for 2013 to 2018

Figure 4.29 shows a trend which clearly reflects seasonal variation in particular for the months of the year (April-May) when the lodge is operating at reduced capacity. From the graph it can be seen that Ramadan does not appear to have much influence over and above stronger seasonal trends. The closure of the Lodge between April and May is quite evident, showing a decrease in guest numbers as well as having a concomitant effect on reduced fish purchases. There is an obvious peak in fish purchases in November, notwithstanding a slight decrease in guest numbers. Notwithstanding the lack of species-specific data, it would appear that a

particular fish is either in season or more popular at this time of year, or that fish species being caught are larger than other times of the year. This relates back to the finding that Nungwi during early December larger species of fish were being caught like Dorado, Sailfish and Tuna. A similar trend is observed in March.

Table 4.10 Pearson's correlation coefficient for guest fish purchases and guest occupancy

Variable	Correlation	Fish	Guest nights
Fish	Pearson Correlation	1	0.593**
	Sig. (2-tailed)		0.01
	Sum of Squares and Cross-products	1268697.070	848443.618
	Covariance	18935.777	12663.338
	N	68	68
Guest nights	Pearson Correlation	0.593**	1
	Sig. (2-tailed)	0.01	
	Sum of Squares and Cross-products	848443.618	1612535.882
	Covariance	12663.338	24067.700
	N	68	68

** Correlation significant = p<0.01 level (2-tailed)

The results indicate that there is a reasonably strong positive correlation between guest occupancy and guest fish purchases made by the Lodge. The R-value of 0.593 is statistically significant with a p-value less than 0.01. It can thus be concluded that the more guests there are staying at the lodge, the more fish the lodge have to purchase to service the increase in demand.

4.4.3 Socio-economic and educational issues affecting fish stocks

This section aims to analyse whether the lack of basic education and skills amongst villagers are affecting fish stocks. The lack of basic education has resulted in a society which is almost entirely dependent on a subsistence way of life, with a very simple hand-to-mouth way of living. Furthermore, this has also resulted in many of the male villagers opting to become fishermen as opposed to any other form of income generation as for many of them they do not possess any other skills.

The analysis of the results is also in line with the literature on the subject and is supported by the study by Lange (2015) in which it was stated that many Zanzibaris do not receive adequate education at the primary and secondary levels, making them less able to take advantage of the tourism training programs offered by government and private organisations. The study conducted by Benansio *et al.,* (2016) reported that after discussions with local fishermen, their perception is that a reason for the high number of fishermen in Zanzibar could be attributed to the lack of suitable arable land for farming. Furthermore, the fishermen stated that many Zanzibaris are forced to become fishermen as they often cannot afford to send their children to school due to a lack of funds to pay school fees.

This relevance of this is further highlighted by the author's own observations and findings conducted through interviews with the local villagers. Many of the older generation fishermen stated that they believe that catch rates have decreased since they first became fishermen. Further to this, they stated that they have to travel further to catch fish as well as some species not being caught anymore or have become somewhat difficult to catch as their numbers have decreased. Thus, the author believes that the factors which have resulted in this is due to: the lack of opportunities for any other form of income; lack of education; lack of skills; increased demand for marine resources; and growing population.

The fishing communities in Zanzibar are heterogeneous, for example in terms of fishing gear used or attitudes and opinions concerning the government (Lindström, 2012). As managing small-scale fisheries is a complex endeavour (Chuenpagdee & Jentoft, 2007), shortcomings in local fisheries management have also been described for Zanzibar (De la Torre-Castro, 2012; Lindström, 2012). In a study conducted by Lange (2015), it was reported that in Zanzibar, large hotels that cater for all-inclusive package tours are currently dominating the tourism sector. The Zanzibari government obtains most of its tourism revenue from this type of hotels, and thus they have less interest in making ecosystem health a priority. With the expanding coastal infrastructure, local fishermen's access to the coast has been impacted. A question then arises, "is tourism and driver for ecological degradation?"

This study has opened up several avenues that can be attributed to the possible reduction in fish stocks, or the sizes and species of fish being caught. The problems

associated with the increased numbers of fishermen cannot only be attributed to the increased numbers of tourists or tourist facilities, it can also be attributed to the lack of basic education and skills of many Zanzibaris. The social issues which underpin Zanzibar is one of the main factors which drives so many people to rely on fishing as their only form of income and sustenance. Often, to become a fisherman is the only option which a majority of male Zanzibaris have as their lack of basic skills to survive in an ever changing 21st century world is very evident. In order to address these challenges, a social reform needs to be initiated by the Zanzibari government, which aims to enhance and diversify the skills of the local people to afford them with better opportunities to improve on their livelihoods and to not solely rely on the marine environment to provide them with a means of sustenance and income.

4.5 CONCLUSION

The Zanzibar small scale fishery, being traditional and artisanal in nature in one which is complex to manage. However, the fishing practices and methods currently being used by fishermen are deemed non-destructive, and despite the frequency of fishing activities, the marine environment can be considered to be in a fairly good state. Perceptions of fishermen indicate that there may be a reduction in fish stocks, however, there are differing views amongst the fishermen. The local market is by far the largest market for fish purchases, however, the hotels and tourism establishments influence which species of fish are most in demand and thus influence the species of fish which the fishermen target. It is believed that the current fishing methods being used should not deplete the fish stocks, however, with effective and inclusive management, the stocks could be in a much healthier state.

Chapter 5
SYNTHESIS, RECOMMENDATIONS AND CONCLUSION

> *Africa's economies continue to grow at remarkable rates, including through the exploitation of the rich endowment of land-based natural resources and commodity exports. Converting this growth into quality growth, through the generation of inclusive wealth, within environmental limits and respecting the highest social considerations, requires bold new thinking. It also involves the creation of jobs for a population on the rise.* (United Nations, 2016, p. x)

5.1 INTRODUCTION

The synthesis follows on from the analysis in Chapter 4 and aims to summarise the previous chapters in the study by amalgamating the aims and objectives together with the literature study, data analysis and results. This chapter will conclude with highlighting the limitations of the study and providing recommendations related to the fish stocks and sustainable fishing practices for community fishing practices of the villages who access the Mnemba Island fishing grounds.

5.2 SYNTHESIS

This study investigated community fishing practices currently being adopted by local fishermen operating in the waters around Mnemba Island. The island of Mnemba and the villages of Matemwe and Nungwi were chosen as study areas where informal talks and structured interviews were held with local fishermen and local villagers. Through these informal discussions and interviews, it was determined that a greater majority of the fishermen are aware and abide by the rules set out by the MIMCA. Despite their lack of enthusiasm towards the restrictions imposed, they are aware of its goals and intentions of implementation. The older fishermen believe that there is a reduction in fish stocks, both by size and species, whereas younger fishermen are of the perception that fish stocks remain stable.

There seems to be consensus amongst the fishermen that one of the limiting factors for them is the primitive and outdated fishing gear that they currently use. However, they stated that the reason for this is that they have no access to proper funding to attain better suited fishing and diving equipment. Hence, a majority, not all of the fishermen, indicated that a larger percentage of fishermen fish in shallower waters closer to shore as their fishing vessels are too limiting to travel to access deep waters. There is an exception in the case of Nungwi, where fishermen stated that they would travel as far as Pemba to access fishing grounds when the need arises.

This study revealed that the increased number of tourist lodges and hotels has resulted in an increase in the number of fishermen in the area on account of the rise in demand for marine resources for human consumption. Had these villages been left as subsistence areas, where no tourism activities and its associated impacts are present, it would be safe to assume that the fish stocks and reefs in the waters surrounding Mnemba, Matemwe and Nungwi would have remained fairly healthy and stable.

Based on existing literature, it was determined that subsistence methods of fishing using traditional fishing gear is far less destructive than commercial fishing methods. The fact that a large majority of traditional Zanzibari fishermen are unable to attain simple items, such as freezers to store excess fish, indicates that despite fishermen fishing every day, the amount of fish caught is limited because of the lack of adequate equipment to store fish. Consistent fishing along the same reefs on a daily basis may have a negative impact on occurring fish stocks. A possible solution for this would be to educate fishermen to adopt varying fishing techniques, such as reef rotation, where the same reefs are not fished on every day and rather left to restore over time.

Should appropriate fishing management methods be formulated with the input of indigenous knowledge, and the exclusion of commercialised fishing practices, the fish stocks on the reefs and fishing grounds around the three study areas should remain stable. Based on the findings of the study by Lange and Jiddawi (2009), the following needs to be undertaken in order for government agencies to better manage the marine-based economy:

- Accurate information about fish catch, capacity and effort is needed for management to better understand both the pressure on fisheries and the contribution of fishing to livelihoods along the entire value-chain.
- Accurate information about tourist arrivals and the tourism economy is critical, as the current system of recording tourist arrivals misses about 35% of tourists.
- Accurate data about government revenues generated by tourism is needed from the Ministry of Finance to provide overall direction to the macro-economy. Presently, at least a dozen different government agencies levy various taxes and fees in an uncoordinated way and do not provide audited reports to the Ministry of Finance.
- With more accurate information, the Ministry of Tourism can define its objective in terms of a target level of income (to all stakeholders including Government) from tourism, rather than a target number of tourists, and design the policies needed to achieve that target level of income.
- Institutional leadership is needed to address utilisation of the marine ecosystem in a coordinated fashion. Currently, management and decision-making are highly fragmented, supported by the practice of each agency levying its own fees, and lack of a centralised revenue collection process.
- Difficult decisions must be made about Zanzibar's fisheries, and this cannot be done without accurate information and leadership. Re-thinking open access may be needed to prevent the collapse of Zanzibar's fisheries.

5.3 CONCLUSIONS OF FINDINGS RELATED TO STATED OBJECTIVES OF STUDY

This section summarises the findings of the study and relates them back to the objectives and the related literature. The data provided by the Lodge, as well as through the interviews and informal discussions have shown that there are many factors that have resulted in the increase in the number of fishermen. These can be attributed to the increase in tourism, which in turn resulted in an increase in demand for marine resources for consumption. The results showed that despite the perceptions of older generation fishermen that fish stocks are declining, the data provided by the Lodge shows that the amount of fish being bought by the Lodge has increased over the 6-year study period. Issues that need to be addressed would be

to diversify the skills of local people, thereby affording them opportunities to do other forms of work so that they are not solely reliant on the ocean.

5.3.1 Objective 1

The literature indicates that tourism has a direct impact on the livelihoods of local people. When relating this to Zanzibar, it has shown that the main tourist attraction in Zanzibar is also a primary means of sustenance for both local people and tourism. This has resulted in an increase in demand for the ocean to provide ecosystem goods and services and has thus influenced the types and species of fish targeted by local fishermen. There was a strong correlation between guest fish purchase and lodge occupancy at the Mnemba Island Lodge.

Through data collection from differing sources, namely literature, primary data collected by means of interviews and statistical data provided by the Lodge, it was concluded that there is no specific species of fish that local fishermen target. Without modern fish finders, it is almost impossible to predict which fish will be caught and thus, based on indigenous knowledge, fishermen use different size nets, dema traps and hook-and-line techniques to target different species. However, if a specifically targeted species is not caught then the bycatch caught is kept and sold to the local market. The tourism hotels and restaurants prefer specific species of fish and thus this influences which species of fish are targeted by the fishermen. These species include larger species such as Dorado, Sailfish, Kingfish, Grouper, etc. Bycatch would include reef fish, Eels and Snakefish, which is not sold to hotels, but rather to the local market.

5.3.2 Objective 2

Traditional fishing methods are artisanal in nature and all of the fishermen interviewed used passive fishing gear, such as dema traps, hand lines and nets. The literature study disclosed that destructive fishing methods are used, such as dynamite fishing, drag nets, etc. However, no destructive methods were recorded whilst conducting the data collection. According to the literature, the importance of fishing is seen as a means of providing foods for millions of people worldwide, and Zanzibar is no exception, with a large majority relying on marine resources for daily consumption.

Traditionally and currently, the fishing techniques being used by fishermen are deemed non-destructive but have not advanced in terms of the use of modern equipment. Spear fishermen used old goggles and snorkels when undertaking spear fishing, with inadequate clothing consisting of a simple shorts and T-shirt when diving in the deep sea. It is safe to assume that despite the frequency of fishing activities in Zanzibar, with the outdated and traditional fishing gear used, it is almost impossible to overfish and to deplete a resource severely.

5.3.3 Objective 3

The greatest threat to fisheries in Zanzibar would be adopting a commercialised fishing industry, which would compromise Zanzibar's marine resources. Although no destructive fishing methods were noted to have been used by fishermen, should the introduction of a commercialised fishing industry be implemented, destructive methods of fishing will most definitely be assumed by local fishermen as they will feel the pressure of the demands of the international market. This will undoubtedly compromise Zanzibar's marine environment and ultimately the livelihoods of its people. In order to ensure sustainable resource use, a sustainable livelihoods approach should be assumed, which includes the input from local people and takes indigenous knowledge into consideration.

5.3.4 Objective 4

Traditional fishing methods currently being used by fishermen in Zanzibar could be considered sustainable and non-destructive. However, the increase in demand for marine resources has placed greater pressure on provision by the ocean. In order to ensure sustainable resource use, sustainable resource management focusing on sustainable livelihoods should be adopted.

This would require capacity building and educating fishermen on the implications of resource depletion, thereby providing local people with a scientific based knowledge on how to manage fish stocks in the waters of Zanzibar effectively. These measures would include reef rotation, the introduction of times of the year when certain species are prohibited to be caught, as well as quota systems. These recommendations imply that fishermen should not fish off the same reefs every day, but rather allow the reefs time to recover between fishing periods. This would require proper

enforcement and management of the reefs. By introducing seasonal fishing, where certain species of fish are only allowed to be caught at certain times of the year would allow fish stocks to recover and thereby ensure sustainable management of fish stocks.

In terms of quota systems, an assessment would need to be undertaken to record approximate numbers of fish species and breeding and spawning times. Catch allowances should be introduced that would only allow specific numbers of specific species to be caught at specific times of the year. To achieve this, effective enforcement tolls should be instituted that would include catch receipts and dockside monitoring of vessels. However, despite these recommendations, the very worst scenario Zanzibar could follow is to adopt a commercialised fishing industry, which will most likely result in the exclusion of local artisanal fishermen and the destruction of the Zanzibari subsistence-based life.

Drawing from the literature in the South African context, it is obvious that despite the implementation of policies to manage marine resources, the lack of community inclusion and involvement in drafting the policies, may often result in resistance to the policies. According to Isaacs and Witbooi (2018), once the waters adjacent to communities were declared marine protected areas, people's livelihoods were negatively impacted and led to an increase in poaching. A South African fisherman stated that one of the fishers explained that:

> *We poach during the night and day. Spring tide, during full moon is the best time to go for abalone as we are able to see. We take whatever we see. We do not have any other options, no fishing rights and no restricted areas to fish. We know it is illegal, but we are struggling to survive.* (A fisherman)

According to the UNGA, states should discharge their duties to respect, protect and fulfil the right to food in the fisheries sector by moving towards sustainable resource use, while ensuring that the rights and livelihoods of small-scale fishers and coastal communities are respected and that the food security of all groups depending on fish is improved.

By relating to the South African small-scale fisheries context, it can be seen that, although there is a lack of enforcement and control in terms of the fishing sector in Zanzibar, the communities who live off the ocean and its resources are far better off

than those communities in the South African context, despite the adoption of “effective management” of marine resources. Although the countries are very different in nature in terms of economic and GDP status, the poor and vulnerable always remain the ones who are left to suffer. Thus, the comparison of South Africa to Zanzibar was chosen for two reasons, firstly the fact that the researcher is familiar with the South African context and secondly that much like South Africa, Zanzibari fishermen are traditional artisanal fishermen, who rely on the ocean for sustenance and a means of income and are at risk of losing their income due to globalisation and a changing world economic climate, where the value of the ocean is now being understood better, exploited and destroyed.

5.4 LIMITATIONS AND SHORTCOMINGS

While conducting the study, the researcher was faced with several limitations.

5.4.1 Language barrier during data collection

The researcher encountered limitations in the form of a language barrier. The first language and mother tongue of the researcher is English and the language of the local Zanzibari respondents being Swahili. Although a vast majority of Zanzibaris speak English, their vocabularies are limited, and this resulted in some of the questions being asked by the researcher not being understood by the respondents.

5.4.2 Disinterest of potential research respondents

Numerous possible respondents were approached in order to conduct interviews and discussions. A small proportion of these respondents were disinterested in participating in the study. This may have been as a result of a lack of understanding of the purpose of the study that could not be successfully overcome.

5.4.3 Religious and cultural barriers

The researcher being of Islamic faith is aware of the possibility that women respondents would not be willing to be interviewed or spoken to. Zanzibar consists of a Muslim majority who strictly follow Islamic teaching that prohibits women from talking to or engaging with strange men. This was encountered because not a single local Zanzibari woman was willing to enter conversations.

5.4.4 Gaps in data of Lodge

The statistical data provided by the lodge was inconclusive for the years 2013-2015. This resulted in inconclusive results and graphs. Fish and octopus purchase data was not recorded for each month and thus the totals and averages were not representative. Furthermore, the data does not include the species of fish bought, thus a comparison of species could not be undertaken. Had accurate species recording been available, it may have been possible to provide informed recommendations on which species of fish to buy.

5.4.5 Limited budget

This research was undertaken with a limited budget, which resulted in restrictions with regard to travelling within and between villages. If an unlimited or larger budget had been allocated, the following could have been embarked upon to conduct a more in depth and comprehensive study:

- More travelling between villages;
- Longer duration of stay for data collection;
- Increase in the number of areas included for the study;
- Appointment of an interpreter to overcome the language barrier; and
- Opportunity for the researcher to accompany fishermen on fishing trips.

5.5 RECOMMENDATIONS

This section will provide recommendations for the Government, for further study and for the management of fishing in Zanzibar.

5.5.1 Recommendations for the Government

This research has opened up avenues for establishing sustainable resource management, both on land and at sea. It has further shown that an increase in tourism could have detrimental impacts upon a fragile environment, through resource depletion and environmental degradation. Despite this, in order to manage the current situation in Zanzibar, a more integrated approach to resource management would need to be adopted by the Zanzibari government to ensure the sustained future of its tourism industry and its local people. This could be achieved by educating the local people on managing their livelihoods, but also acknowledging

their role in assessment of the situation and buy-in in new policy ideas, by diversifying their income generating avenues through education and skills development, as well as by providing local fishermen with proper training and skills on how to operate larger fishing vessels and modernised equipment. This would concede the regeneration of overfished nearshore waters by reducing pressure on these overfished areas and thereby positively contributing to sustainable resource management.

5.5.2 Recommendations for further study

An avenue that should be researched is the ecosystem resilience to test the actual resilience of the fisheries sector to adapt to changes, such as climate change. To reduce the impact of overfishing possibly, a suggestion would be to build capacity and knowledge of aquaculture as possible future means to provide marine-based food sources for local communities. Instead of focusing solely on the fishermen, focus should be shifted to the consumers (tourist hotels, etc.), whereby consumers make informed decisions when purchasing marine products.

5.5.3 Recommendations for management of fishing

Achieving sustainable fishing practices is not always a straightforward task, as there are significant challenges that ultimately inhibit their realisation, especially in making the transition to sustainability, as reducing catches and introducing new fishing practices to allow fish stock to recover are often necessary, which generally mean hardship for some stakeholders, albeit temporary (Bonini *et al.*, 2011). It is imperative that case studies of artisanal fishers from around the world are addressed to ensure that, as with the case of South Africa, management methods and policies to regulate fishing must not follow the same route as the South African picture.

When developing policies for fisheries and sustainable resource management, indigenous knowledge is key, as the management of marine resources and formulation of policies and laws often relies solely on scientific data, with no regard for local or indigenous knowledge. As with the case of South Africa, the ITQ system has failed the artisanal fisherman, in many cases taking away his very means of income and ultimately, dignity. An integrated policy formulation that takes into

account sustainable development, sustainable resource use and effective biological and environmental management should be adopted when drafting a fisheries policy for Zanzibar, also taking into account the needs of the local communities which these policies aim to serve. This could potentially be achieved by inviting community members to participate in a bottom up policy making process.

The literature review has briefly discussed the South African fishing industry and has highlighted its shortfalls, namely due to the lack of inclusion of indigenous knowledge. The South African small-scale fisheries policy has failed and as a result has destroyed co-operation between coastal communities and may ultimately result in the complete collapse of precious marine resources. Zanzibar on the contrary still has long ways to go in terms of the commercialisation of its fishing industry, and even the adoption of new marine resource policies. However, having said this, South Africa is a good example to examine in order to ensure that the shortfalls of its policies are not implemented in Zanzibar. The current fishing practices of Zanzibar have not yet been commercialised and could confidently be considered to be more environmentally and resource management friendly when compared to South Africa.

5.6 CONCLUSION

The use of current literature and local evidence revealed that the current fishing practices of Zanzibar are purely artisanal in nature. The community fishing practices with the increased tourism and population growth that comes along with it resulted in an increase in demand for marine resources. The study has shown that the perceptions amongst local fishermen are that the amount of fish being caught have decreased over the past decade resulting in a decline in the array of species being caught.

To effectively manage marine resources, integrated and locally indigenous inclusive policies need to be adopted to ensure effective management and future sustainability of the marine resources. The comparison to the South African case study was chosen as an example to illustrate the ways in which it could lead to various other factors associated with restricting a person from practices that have been adopted for generations, if locally indigenous knowledge is not included in

policy formulation, of which one such consequence would ultimately be, poaching. The current fishing practices of the Zanzibari artisanal fishermen are very far from the commercial nature of other fishing areas of the world. Possibly the worst direction that the Zanzibari fishing industry could take would be to commercialise its fisheries sector. By reverting to such a measure, would affect the marine resources of Zanzibar detrimentally.

Factors that need to be considered when drafting a future fishing policy for Zanzibar, would be to include the influence of the tourism market on the fishing industry and the ways in which it has impacted on the local people, through exclusion zones and MPA's, which did not exist in the past. Capacity-building workshops and an investment into educating local people on marine conservation and sustainable resource use, coupled together with possible aquaculture farming, would ensure that the marine resources of Zanzibar are managed effectively and sustainably for future generations.

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Appendix A

MNEMBA ISLAND FISHING SURVEY INTERVIEW (English)

1. What gear did you use for fishing this year?
2. Describe the type of gear (fishing equipment) used this year and not in the past.
3. What fish species do you mostly target?
4. What fish species are most sought after by &Beyond?
5. From which community are you?
6. Do you use the Mnemba Island atoll for fishing or diving?
7. If yes to Q6, do you feel that you benefit from the Mnemba Island atoll?
8. What fish species are most sought after from the local markets?
9. What size vessels do you use, and how many fishermen can the vessel hold?
10. How long is an average fishing trip?
11. How many years' experience do you have as a fisherman?
12. What areas around Mnemba have you fished for this year?
13. How did your catch rates this year compare to last year?
14. How do you relate the current year to the best year you have ever had?
15. In your opinion, has there been a reduction or an increase in the number of fish caught this year compared to previous years?
16. Has the increased tourism affected your livelihood? If YES, has it been positive or negative? Please provide reasons for your answer.
17. How does the condition/size of the fish of this year compared to previous years?
18. How many times a week do you fish?
19. Do you have any other forms of income?
20. What other skills do you have besides fishing?
21. Any further comments are welcome.

Appendix B

MNEMBA ISLAND FISHING SURVEY INTERVIEW (Swahili)

1. Ni gear gani uliyotumia kwa uvuvi mwaka huu?
2. Eleza aina ya gear (vifaa vya uvuvi) kutumika mwaka huu na sio nyuma.
3. Nini aina ya samaki wewe hasa lengo?
4. Nini aina ya samaki ni wengi walitaka baada AndBeyond?
5. Je, ni jumuiya ipi ambayo umetoka?
6. Je, unatumia kivutio cha Kisiwa cha Mnemba kwa uvuvi au kupiga mbizi?
7. Ikiwa ndiyo Swali la 6, unajisikia kuwa unafaidika na uwanja wa Kisiwa cha Mnemba?
8. Ni aina gani za samaki ambazo zinahitajika zaidi kutoka kwa masoko ya ndani?
9. Ni vyombo gani vya ukubwa unayotumia, na ni wapi wavuvi ambao wanaweza kushika chombo?
10. Safari ya wastani ya uvuvi ni muda gani?
11. Ni uzoefu gani wa miaka mingi unao kama mvuvi?
12. Ni maeneo gani yaliyo karibu na Mnemba ambao umefungwa kwa mwaka huu?
13. Je, ulipataje kiwango cha mwaka huu kulinganisha na mwaka jana?
14. Je, unahusianaje na mwaka uliopo kwa mwaka bora zaidi uliopata?
15. Kwa maoni yako, kumekuwa na kupunguza au ongezeko la idadi ya samaki waliopata mwaka huu ikilinganishwa na miaka iliyopita?
16. Je! Utalii uliongezeka uliathiri maisha yako? Ndiyo, imekuwa chanya au hasi? Tafadhali kutoa sababu za jibu lako?
17. Hali/ukubwa wa samaki wa mwaka huu ikilinganishwa na miaka iliyopita?
18. Ni mara ngapi kwa wiki unapiga samaki?
19. Je! Una aina yoyote ya mapato?
20. Ni ujuzi gani mwingine unao badala ya uvuvi?
21. Maoni yoyote zaidi yanakaribishwa